



1978-1979

Rush-
Presbyterian-
St. Luke's
Medical
Center

Chicago

Rush University
College of Health Sciences
and
Graduate School
Bulletin



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Rush University College of Health Sciences and Graduate School Bulletin

This bulletin is published for the faculty, students, and prospective students of the College of Health Sciences of Rush University. The university reserves the right to make changes in any or all specifications contained herein and to apply such revisions to present and new students alike.

Rush University
The College of Health Sciences
600 South Paulina Street
Chicago, Illinois 60612
(312) 942-7100

Rush University Programs in the Health Professions

1978-1979

College of Health Sciences

Bachelor of Science
Medical Technology
Master of Science
Clinical Nutrition
Health Systems Management
Doctor of Philosophy
Anatomy
Biochemistry
Immunology
Pharmacology
Physiology

Rush Medical College

Doctor of Medicine

The College of Nursing

Bachelor of Science
Master of Science with majors in
Anesthesia Nurse Practitioner
Community Nurse Practitioner
Gerontological Nursing
Medical/Surgical Nursing
Oncology Nursing
Psychiatric Nursing
Rehabilitation Nursing
Non-degree
Nurse Practitioner Tracks
Adult Health
Obstetrics/Gynecologic
Pediatric
Doctor of Nursing Science

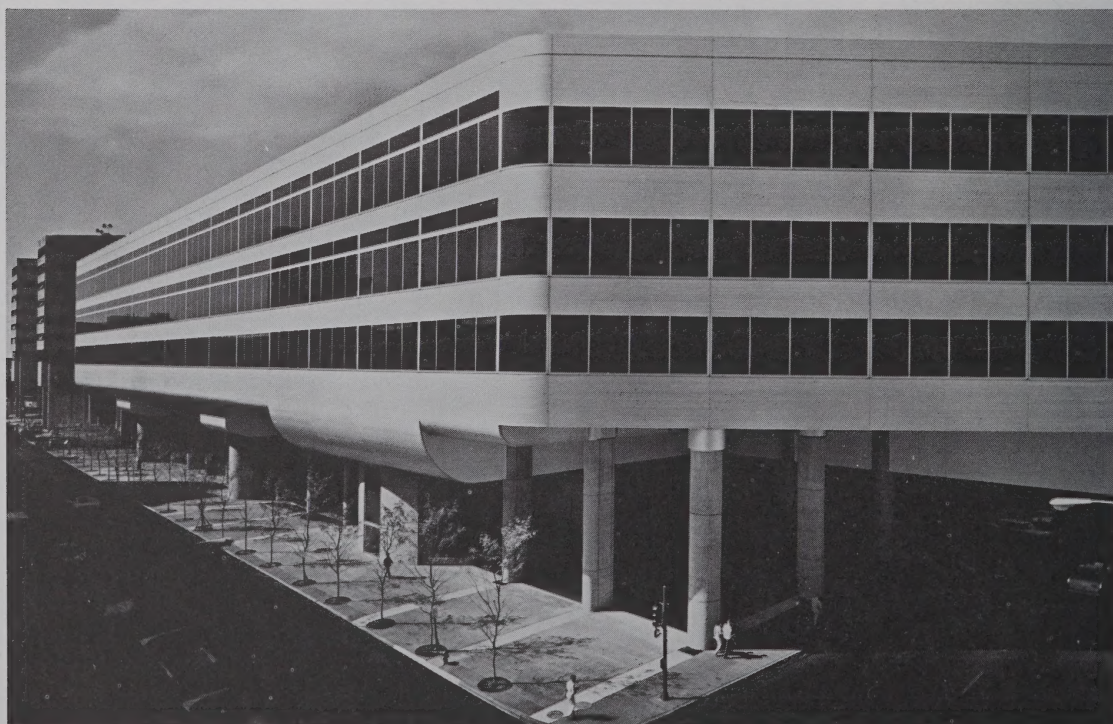
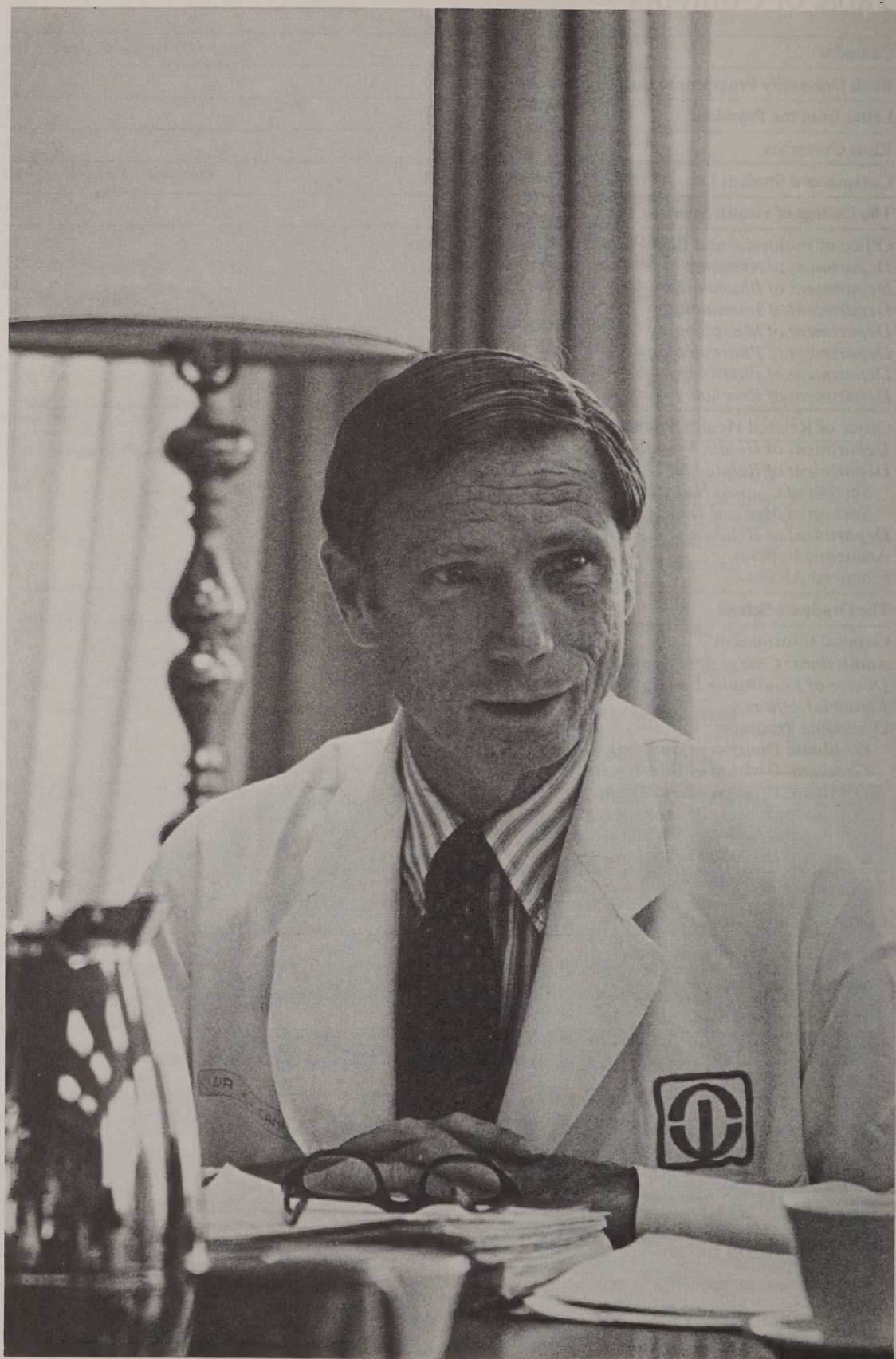


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The concept of an academic health center has gained recognition throughout the United States as an important organizing principle for patient services, scientific inquiry, and health education. At Rush-Presbyterian-St. Luke's Medical Center, our approach in the development of such a center is based on a commitment to orderly and balanced growth among all the components — patient care, education, and research.

The College of Health Sciences and its Graduate School arise out of the strengths of these components. This college and its sister colleges of medicine and nursing comprise Rush University. The university, therefore, exemplifies the concept that an organized system of patient care must produce the individuals necessary to optimal provision of such care.

The College of Health Sciences, through its basic and applied science faculties, has a number of charges expressive of the overall goal of the medical center. It is largely responsible for developing and maintaining a level of excellence in furthering investigation of the increasingly complex problems related to the understanding of health and its impairments. It is

responsible for the education of students in those professional scientific areas needed to support the most effective approaches to health care. It is also responsible for the doctoral education of students in those basic biological and behavioral research skills that are fundamental in gaining understanding of the human condition. In all of its programs, the college appropriately is committed to the belief that scientists and professionals, in areas of health care other than medicine and nursing, are an integral part of the health care endeavor.

To those of you who will enter the college as students, I extend the welcome of our Medical Center and university and the invitation to share our objectives. Your responsibility is to grow. Our responsibility here is to nurture your growth in every way we can.

James A. Campbell, M.D.
President



The University

The establishment of Rush University in 1972 by the Trustees of Rush-Presbyterian-St. Luke's Medical Center represents a combined heritage that stretches back to 1837. On March 2 of that year, the Illinois State Legislature chartered Rush Medical College — two days before the city of Chicago was incorporated.

The Rush Medical College tradition began with Dr. Daniel Brainard, the founder, and Dr. Benjamin Rush, a signer of the Declaration of Independence and the physician for whom the College was named. Dr. Brainard was a distinguished surgeon and scientific investigator who led Rush Medical College to exert strong influence on medical practice and scientific research. Two years after the establishment of the Medical College, Dr. James Van Zandt Blaney, a member of the faculty, opened the first free medical dispensary west of the Allegheny Mountains. It became known as the Central Free Dispensary in 1873. In 1864, St. Luke's Hospital was founded, and, in 1883, Presbyterian Hospital. All three institutions merged in 1956 to form Presbyterian-St. Luke's Hospital and Health Center. In 1969, Rush Medical College merged with the Hospital to create Rush-Presbyterian-St. Luke's Medical Center.

In 1885, the first antecedent of the College of Nursing, the St. Luke's Hospital Training School of Nurses, opened its doors to offer diploma education in nursing. In 1903, the Presbyterian Hospital School of Nursing accepted its first students, and from 1956 until 1968 nurses were taught at the merged Presbyterian-St. Luke's Hospital School of Nursing. Before the establishment of the College of Nursing in 1973, a total of 7,221 nurses had graduated from these three schools. Many made outstanding contributions to the field of nursing.

The College of Health Sciences, established in 1975, is the newest academic component of Rush University. Its present elements include pre-existing basic science depart-

ments of the Medical Center, organized within the Office of Biological and Behavioral Sciences and Services; a number of departments of related health sciences, organized within the Office of Related Health Sciences; and finally, the Rush Graduate School.

The mission of the college is to exercise responsibility for the education and training of undergraduate students, graduate students, and postgraduate fellows in those degree programs which the faculty generates, from the baccalaureate through the doctorate. The college is also responsible for the continuing development of research programs, the application of new knowledge to improve health care, and the teaching of basic sciences in other colleges of the university. In all of its educational programs, the college is particularly committed to the concept that scientists and professionals in areas of health care other than medicine and nursing are also an integral part of the health care endeavor. Their education, therefore, is seen as central to the growth of a more successful system of health care delivery.

Today, Rush University continues to build upon its tradition of commitment to the education of future health care practitioners and to the establishment of a rational system for the delivery of care to all segments of the population. The university is fully accredited by the North Central Association of Colleges and Schools to offer programs leading to the baccalaureate, master's, and doctoral degrees. As an integral element of Rush-Presbyterian-St. Luke's Medical Center, Rush University is part of a cooperative health care delivery system that serves approximately 1.5 million people through its own resources and those of affiliated health care and academic institutions. At the Medical Center, more than \$6 million is budgeted each year to carry out basic research and clinical investigation in traditional disciplines and in multidisciplinary areas, as well as in nursing and related health.



Campus and Student Life

The Campus

The College of Health Sciences, the College of Nursing, and Rush Medical College are located on the campus of Rush University at Rush-Presbyterian-St. Luke's Medical Center on Chicago's near west side. The Medical Center includes: Presbyterian-St. Luke's Hospital; the Marshall Field IV building, an out-patient mental health facility; research buildings where more than \$6 million is budgeted each year to carry out basic scientific and clinical investigations; academic facilities for Rush Medical College, the College of Nursing, and the College of Health Sciences; a professional office building; apartment buildings; the Laurance Armour Day School for children of employees and students; and the Johnson R. Bowman Health Center for the Elderly. The Sheridan Road Pavilion on Chicago's north side is operated as an integral part of the Medical Center.

In September, 1976, the new Rush-Presbyterian-St. Luke's Medical Center Academic Facility was dedicated. The structure is the hub of activity of Rush University and accommodates large class activities, small group seminars, and individual instruction. The deans' and admissions offices for all colleges are located in this building. It has direct internal access to the Professional Building and patient care and research facilities. Involvement of students with faculty and staff at these adjacent facilities is an integral element of the academic programs at Rush.

The new building includes a large multidisciplinary laboratory surrounded by 10 unit laboratories. Each unit houses 16 student stations for basic science studies. A separate

gross anatomy laboratory is designed on the same modular concept. A central demonstration area and model room is accessible from four dissecting modules, each with six tables. Two 150-seat lecture halls are designed to utilize all types of media presentations and live demonstrations. The Center of Educational Resources supports all instructional activities for faculty and students, including the Library, the Learning Resource Center (equipped with 31 audio-visual study carrels), Computer Assisted Instruction, Biomedical Communications, Animal Resource Facility, and Curriculum and Evaluation.

The Library of Rush University, which serves the entire university campus, the oldest medical library in the city of Chicago, is located in the new Academic Facility. It is administered by a staff of professional medical librarians. The library has approximately 80,000 volumes, subscribes to 1,400 periodical titles, borrows documents from inter-library loan, and processes MEDLARS, MEDLINES, and AV-LINE requests for patrons. New monograph and reference books are acquired at a rate of over 2,000 each year. The library also has an outstanding collection of rare medical books available for research and study.

Schweppe-Sprague Hall houses new laboratories for basic and clinical sciences, lecture rooms, classrooms, and student lounges. Student support offices and the bookstore for the university are on the first floor. The services of the Registrar, Financial Affairs, Student Affairs, Financial Aid and Counseling Center are available to all university students.

Clinical Experience

Students of Rush University receive their clinical training primarily at Presbyterian-St. Luke's Hospital, a voluntary, not-for-profit hospital with a professional staff of about 700 physicians and scientists, 921 nurses, and 300 house staff who receive graduate medical education in over 30 specialty areas. Students also spend clinical time at other agencies and

institutions in the Chicago area. Each year more than 27,000 patients are admitted to the hospital, which has 862 beds and 34 bassinets. By tradition each patient participates in the teaching programs of Rush University. The hospital is directly across the street from Schweppe-Sprague Hall.

In clinical settings, health science students are required to wear white laboratory coats.

Affiliated Hospitals

Affiliated hospitals and a community health center are cooperating with Rush-Presbyterian-St. Luke's Medical Center to

Participating institutions are:

Bethany Hospital, Chicago:	128 beds	Mount Sinai Hospital Medical Center, Chicago:	440 beds
Central DuPage Hospital, Winfield:	237 beds	Swedish Covenant Hospital, Chicago:	235 beds
Christ Hospital, Oak Lawn:	809 beds	West Suburban Hospital, Oak Park:	372 beds
Community Memorial General Hospital, LaGrange:	276 beds	Mile Square Health Center, Chicago:	more than 20,000 patients registered
Galesburg Cottage Hospital, Galesburg:	234 beds		
Schwab Rehabilitation Hospital, Chicago:	67 beds		

provide students and house staff with opportunities to participate in the delivery of health care in a variety of socio-economic settings in urban and rural areas.

Housing and Transportation

Chicago and its adjoining suburbs as well as the university provide a wide variety of off and on-campus housing options. The Office of Student Affairs publishes a "Housing Information Sheet" which outlines these residential opportunities for Rush students. Information regarding current availability of off-campus units, potential roommates, car pools, etc. is also coordinated by student affairs.

On-campus housing is generally available for Rush students with documented need. Written requests outlining the need for on-campus housing should be directed to the Office of Student Affairs. Current on-campus options include a limited number of dormitory spaces as well as some apartment units. Students willing to accept a roommate assignment are given preference for the apartment units.

All housing inquiries should be directed to:

The Office of Student Affairs
Rush University
1743 W. Harrison
Room 101
Chicago, Illinois 60612
(312) 942-6302

A room & board agreement between the university and the Illinois Institute of Technology allows Rush students to apply to live in residence halls on that campus. Students need to be aware that the Rush class schedule may necessitate missing certain meals at IIT and they must make alternate plans in that event. Transportation between Rush and IIT is the responsibility of the individual student.

Public transportation is readily available to and from the Rush campus. The "Congress A" train, from downtown Chicago and western suburbs such as Oak Park, stops two blocks northwest of the campus at the "Medical Center" stop. The "Douglas B" train from downtown and Cicero, stops at "Polk Street," at the south-east corner of the campus. Chicago Transit Authority buses also stop at the campus.

Students who commute by automobile may park in the Medical Center parking facility located on the southeast corner of Paulina and Harrison Streets at a daily or quarterly rate.

Health Services and Counseling

The university has authorized a two-part program of medical service to protect and promote the health of its students. One is Anchor, a health maintenance organization

oriented toward illness prevention which provides a variety of professional services and ambulatory care.

While a student is actively enrolled, single coverage in Anchor is provided at no charge,

however coverage does not begin until an Anchor application is properly filled out and signed at the Office of Financial Affairs. A new application must be filled out during the first week of the quarter *for every new student* and whenever a student is rejoining the Anchor program after a lapse in coverage such as summer vacation.

In addition, every student is required to stop by the Office of Financial Affairs prior to the end of spring quarter and indicate if they want continued summer coverage or not. If summer coverage is desired, they will be required to pay the appropriate fee at that time.

A student's spouse and dependents may also be enrolled in the Anchor program for an additional fee. This can be done by filling out a change in coverage card for family or couple coverage when the student first becomes married or has a child or during open enrollment which is the first week of each quarter.

*Costs for 1977-78 participation were:
(Per Quarter)*

Anchor	While enrolled	Not enrolled
Single	—0—	\$ 39.00
Couple	\$36.00	\$ 75.00
Family	\$90.00	\$129.00

The other program is the Blue Cross Hospitalization Insurance. Each student must maintain this Blue Cross coverage or its equivalent from the date of matriculation until graduation, including summer quarters. Prior to matriculation, students must decide to either join Rush's Blue Cross policy or obtain similar hospitalization coverage elsewhere.

During fall registration all students must sign up for single Blue Cross membership unless they can provide proof of alternative coverage. Such proof consists of presenting a current alternative hospitalization policy or a member identification card. After fall registration a student can only join Rush's Blue

Cross policy during open enrollment which is the first week of each quarter.

If during the school year a student wants to drop Blue Cross coverage he or she must first show proof of similar coverage elsewhere and then can only drop at the end of the current quarter. In addition if a student does drop coverage, he or she can only re-enroll during the first week of fall quarter.

A student's spouse and dependents may also be enrolled in Rush's Blue Cross plan for an additional fee. This can be done by filling out a change of coverage form for family coverage when the student first becomes married or during open enrollment which is the first week of each quarter. A child is covered under the family plan at no additional charge, however the child's name must be added on the policy before the coverage is effective. This can be done by filling out a change of coverage form at the Office of Financial Affairs.

Costs for 1977-78 participation were:

Blue Cross	Per Quarter	Summer Plan
Single	\$ 39.00	\$ 39.00
Family	\$171.00	\$171.00

Students not enrolled in the university are ineligible for the university's Blue Cross coverage.

Professional counselors are available to assist students in educational and vocational planning, emotional and social adjustment, finance, marriage and family, reading and study, or in any other area in which greater self-understanding is sought.

In order to facilitate a free and open discussion of all issues, the university counseling service maintains strict standards of privacy and confidentiality. No information on individual students is released to anyone, inside or outside the university, without the informed consent of the student.

Social and Cultural Activities

The more than 800 students currently on the Rush University campus enjoy a variety of co-curricular activities. The Office of Student Affairs works with students to sponsor organized programs, including University

Nights at local cultural events, on-campus entertainment and social gatherings, and a film series.

The Steering Committee is an elected group of students whose purpose is to provide appropriate representation for all students in

the College of Health Sciences and the College of Nursing. This committee acts as a liaison with faculty, students, and administration for the mutual exchange of ideas and it insures that students will have representation in formulating policies and procedures related to their needs.

The University Programming Board is an elected group of students from all three colleges who work with the Office of Student Affairs to plan and implement co-curricular programs. The group organizes regular student-faculty get-togethers, student dances, a ski trip, and other social and educational events.

Chicago's loop area, with its many opportunities to enjoy art, music, drama, films, and museums, is located approximately two miles from campus. It is easily reached by car or

public transportation. Outstanding attractions in Chicago include the Chicago Symphony Orchestra, the Lyric Opera, the Art Institute, the Museum of Science and Industry, the Field Museum of Natural History, the Shedd Aquarium, and the Adler Planetarium.

Lake Michigan provides an ideal site for a variety of activities such as swimming, boating, fishing, bicycling along the lake shore path, and sunning. During the winter months, ice skating and cross-country ski enthusiasts have access to Chicago's expansive parks.

Rush University expects to continue an arrangement for Rush students to use physical educational facilities at the University of Illinois Chicago Circle Campus. The fee structure and procedure for obtaining a pass will be announced in the fall quarter by the Office of Student Affairs.

Career Opportunities

Rush provides students with information concerning job opportunities. The Office of Student Affairs provides information on summer job opportunities particularly between the junior and senior years of the

undergraduate program. The Office of Student Affairs coordinates a Career Fair to acquaint students with job opportunities available at health care agencies after completion of the program.

International Students

Rush University welcomes students from other countries and every effort is made to help the foreign student adapt to life in the United States.

The Test of English as a Foreign Language (T.O.E.F.L.) must be submitted if English is not the applicant's native language. Any evidence in support of the application must have an authorized English translation.

Graduate applicants from other countries must successfully complete the proficiency

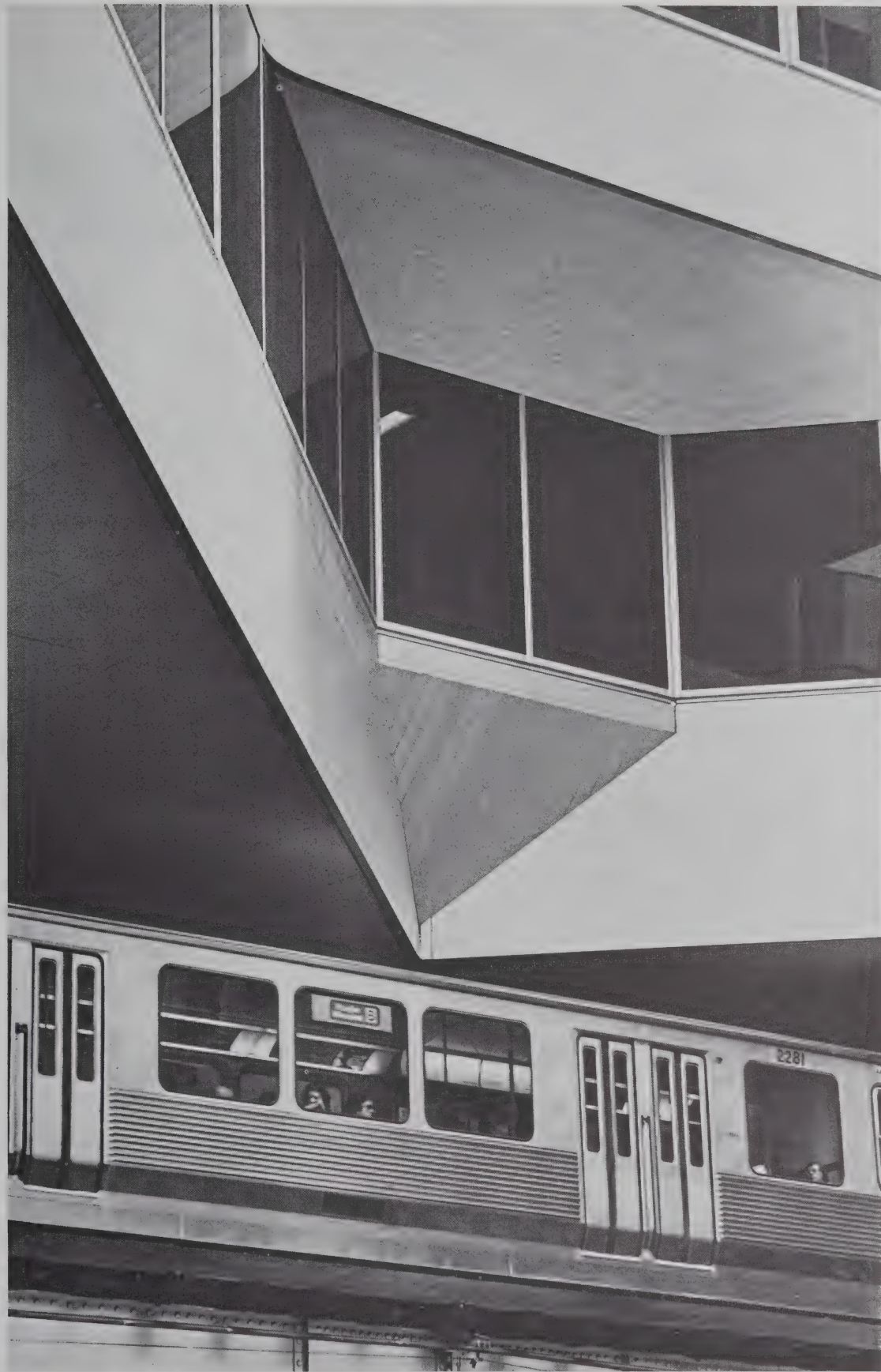
examinations of the College of Health Sciences to determine skills and knowledge in subject matter.

Rush University may educate foreign students only by permission of the United States Justice Department, Immigration and Naturalization Service. Form I-20 will be issued at the request of the student when an offer of admission is made. Foreign students may not work, so they must be able to finance their entire education.

Equal Opportunity

Rush University encourages applications from and gives full consideration to all applicants regardless of race, sex, creed, color, or national origin. Moreover, in furtherance of the nation's commitment to end discrimination on the basis of handicap and in accordance with the provisions of Section 504 of the Rehabilitation Act of 1973 and all regulations properly issued thereunder to protect

the rights of handicapped persons, it is the university's policy that no person or activity administered by Rush University shall exclude from participation, deny benefits to or subject to discrimination, any qualified individual solely by reason of his or her handicap. Ms. Beverly Huckman, Equal Opportunity Coordinator for Academic Affairs, has been designated as the university's coordinator for implementation of these policies.





The College of Health Sciences



The following pages describe the departments and divisions of the college and its Graduate School; their research, educational, and service programs; and the policies and procedures governing student admission and progression.

Office of Biological and Behavioral Sciences and Services

Cecilia Brocken, Ph.D., Associate Dean

Departments

Anatomy	17
Biochemistry	19
Immunology	25
Microbiology	27
Pharmacology	29
Physiology	31
Psychology and Social Sciences	35

Department of Anatomy

Anthony J. Schmidt, Ph.D., Chairperson

Faculty

Colgan, J.
Dinsmore, C.
Durica, T.

Hovde, C.
Hughes, W.
Khedroo, L.

Maibenco, H.
Martinek, J.
Schmidt, A.

Seale, R.

Research Activities

The fundamental search of the faculty in anatomy lies in elucidating the structure and function of cells, tissues, and organs composing the fabric of life of all living creatures. Investigations are conducted in such diverse areas as, for example, DNA synthesis during gestation in the reproductive system, formation of retinotopic projections to the optic tectum and neural plasticity in the chick visual system, corneal lesions and induced microcirculation, cell biology of normal and pathologic mammalian skeletal and cardiac muscle, repair mechanisms in the CNS, developmental morphogenetics, tissue-tissue interaction, induction and organogenesis, protein synthesis and other molecular studies in urodele appendage and spinal cord regeneration. Employed in these investigations are such experimental approaches as surgical manipulations, light and electron microscopy, cryostat histochemistry, radioisotope labeling for autoradiography, spectrophotometric

assay, electrophoresis and isoelectrofocusing procedures. In addition to individual faculty laboratories, the department has developed three special purpose facilities for research, one serving microsurgery, incubations, and organ cultures; a second for bioassays; and a third for microtomy.

Interdisciplinary collaboration is encouraged, especially where clinical application may evolve from basic research. In particular, we currently participate in ongoing investigations into the biomechanics of human locomotion, and the problems of the lumbosacral region of the back conducted within the Gait Laboratory of the Department of Orthopedic Surgery. There is a continuing collaborative study into the neurobiology of the visual system in the Helen Regenstein laboratories within the Department of Ophthalmology. These and other affiliations bespeak the broad interest and research activities of the faculty.



Educational Activities

The primary purpose of the anatomical sciences in our medical curriculum is to assist the student to develop a working concept of the morphology of the human body. The anatomical programs are instructive in the gross and microscopic architecture of the human body relevant to the body's functions and to its embryological origins. As a science, anatomy is fundamental to the health professions and its understanding is essential to the art of medicine.

To understand the structural details and complex relations of parts of the human body, the very basis of its activities, you must take it apart yourself. Therefore, a laboratory experience in the direct study of the human body is very important in anatomy (*anatome* = to cut up, Gr.). The student will devote much time in the laboratory dissecting a cadaver by region, gradually developing a personal conception and appreciation of the human body. To assist in this learning process, frequent reference is made to living anatomy and to clinical correlations. Lectures, preceptorials, and audiovisual aids serve to enrich the student's education.

The histological and ultrastructural organization of the human body is studied to develop a sound understanding of the microscopic architecture and functions of cells, tissues, organs, and systems. Though the inseparable relationship to the normal healthy structure and function of the body is evident, microscopic anatomy also is essential to recognizing the clinical pathologies of disease. A laboratory experience with microscope and prepared slides is an important part of the program, which includes coordinated introductory and conceptual lectures, and preceptorial discussions.

Neuroanatomy is taught as part of the neurobiology program in which sound concepts of the gross and microscopic organization of the central nervous system are essential to understanding functional neurology. In addition to lectures, students will have an opportunity to visualize the complexities of the CNS in the laboratory, where they will dissect the human brain and study specially prepared slides of the brain stem. Also, there are plastic embedded gross coronal sections, select models, and other audiovisual aids to assist in the learning process.

Department of Biochemistry

Howard H. Sky-Peck, Ph.D., the John W. and Helen H. Watzek Chairperson

Faculty

Anderson, K.	Dubin, A.	Kanamarlapudi, N.	Quarfoot, A.
Bezkorovainy, A.	Harris, L.	Kornel, L.	Rafelson, M.
Booyse, F.	Harrison, W.	Kuettner, K.	Sky-Peck, H.
Chang, M.	Hayashi, J.	Kumar, S.	Swenson, J.
Cohen, M.	Hof, H.	Lobstein, O.	Tulloss, J.
Cole, E.	Hoskin, F.	Mattenheimer, H.	Weinstock, H.
Demidow, L.	Kachmar, J.	Miller, R.	Whisler, W.
		Morley, C.	

Research Activities

The members of the Department of Biochemistry conduct a broad range of independent research activities, which include collaborative research programs with investigators in other departments of Rush-Presbyterian-St. Luke's Medical Center, Mount Sinai Hospital Medical Center, the University of Illinois, Northwestern University, the University of Chicago, the Mayo Clinic and Research Foundation, the Ames Company, and the Hektoen Institute for Medical Research. The diverse research interests of the faculty provide expertise in the areas of protein chemistry and functions, DNA metabolism and cell regulation, thrombosis, cartilage structure and metabolism, neurochemistry and the aging process, enzymology, hormone metabolism, cancer metabolism, and immunity.

The overall research programs consist of projects in these general areas and are briefly described below.

Study of Von Willebrand Disease and Thrombosis: Studies are continuing on the nature, mechanism, and site of platelet-vessel wall interaction as a means of better understanding the underlying mechanism(s) and role of these structures and cells in normal hemostasis, von Willebrand's disease, and thrombosis.

Established lines of cultured aortic endothelial cells (bovine and porcine) are used to study and further characterize the reactions and factors that affect long-term endothelial cell maintenance, proliferation, morphology, and ultrastructure. Isolated platelets are used to study the mitogenic and/or nurturing effect of these cells on cultured endothelial cells and involves the further isolation and physiocochemical characterization of the platelet-derived

mitogenic factor(s). Platelets also are used to study the specific reactions and factors involved in platelet-subendothelial component (microfibril) interaction—the microfibril to which platelets attach in the vessel wall have been identified immunologically and are being isolated and characterized further. In addition, various endothelial-produced, basement membrane-associated macromolecules such as collagen, elastic, ristocetin-Willebrand factor (RWF), and platelet factor 4 (PF4) are being characterized in terms of their molecular type, structure, composition, localization, synthesis, immunological properties, and role in platelet-vessel wall interactions. These studies are supplemented by various studies on the uptake and release of biogenic amines by endothelial cells in response to various vasoactive agents and analysis and identification of surface associated endothelial cell proteins.

Biochemistry of Bone and Connective Tissues: One biochemistry program in collaboration with the Department of Orthopedic Surgery involves studies on the molecular organization of the extracellular cartilage matrix. Epiphyseal cartilage is both avascular and non-calcified. Shortly before this cartilage is replaced by bone, it calcifies and becomes invaded by capillary sprouts. Accompanying these two changes, a series of events occurs that culminates in the resorption of the calcified cartilage matrix and the formation of bone. We have been particularly interested in the smaller molecules in this tissue and have now isolated and partially characterized two such biologically active molecules, lysozyme and a cationic protein that acts as a protease inhibitor. Each appears to play an important role in the metabolism of cartilage. The molecular arrangement of pro-

teoglycans in a very specific aggregated state has been shown to be involved in the inhibition of calcification. We have been able to show that mammalian lysozyme plays a role in governing this "state of aggregation" of matrix proteoglycans and therefore may regulate cartilage calcification. Since aggregated proteoglycans seem to be diminished in the osteoarthritic cartilage matrix and lysozyme is both elevated and present in an active (uninhibited) form, it can be implicated in the etiology of degenerative arthritis.

In addition, another aspect of this study deals with the role of the protease inhibitor that this laboratory discovered in cartilage, aorta, and other connective tissues. Cartilage is one of the few tissues in the body that lacks a capillary blood supply. Clinicians and pathologists, however, have long shown that cartilage also is rather resistant to invasion by both inflammatory and neoplastic processes. We were able to show that normal human skin as well as endothelial cell-derived collagenase is inhibited by the cartilage-derived protease inhibitor. We extended these studies to neoplasms and found that both human osteosarcoma cells and primary and metastatic mammary carcinomas can be stimulated to secrete a tumor collagenase. This collagenase also is inhibited by the cartilage-derived low molecular weight protein.

Anti-Tumor Invasion Factors Derived from Cartilage: Since cartilage is a "non-permissive" tissue to "normal" and pathologic invasion, we suggest that the inability of cells to encroach upon cartilage may be due to the endogenous specific inhibition within its matrix. If it is hypothesized that invasiveness of a tumor is related to the degree of collagenase production, then it is possible that invasiveness can be regulated by the presence or absence of anti-collagenolytic substances such as specific collagenase inhibitors. Based on our current data, we hypothesize that the resistance of cartilage to penetration by endothelial cells (capillary in growth) as well as invasion by neoplastic cells at least in part is due to specific tissue protease inhibitors. Work is in progress to prove these hypotheses.

Human Milk Proteins: Research reports have described the isolation of a number of glycoproteins with *L. bifidus* growth-promoting activity. During the past year, in an attempt to simplify the isolation procedure for these glycoproteins, the so-called proteoseptone fraction of human milk was prepared by the method used for the preparation of the analogous fraction from bovine milk. Though the proteose-peptone fraction components of bovine milk are related to casein, the human materials were found to be of whey protein origin. The main component of this fraction was α -lactalbumin, and additional components included the small molecular weight glycoprotein previously isolated (as expected), and a so-called "temperature-sensitive protein." This interesting protein precipitated at room temperature and went back into solution at 4°C. It had no carbohydrate, but contained phosphorus. Its amino acid complement was very heavy in proline and glutamic acid, and bore some similarity to that of β -casein. It was hypothesized that the temperature-sensitive protein was really one of the β -casein phenotypes.

Iron Metabolism: The research investigation of iron metabolism was previously focused on the interaction of transferrin with immature red cells. The specific transferrin receptor from the cell surface was purified and characterized. Its molecular weight (minus the transferrin) was near 110,000, and it consisted essentially of a subunit with a molecular weight near 49,000, three subunits with a molecular weight of 17,000 each, and a lipid component accounting for some 5% of the total receptor weight. It contained nearly 10% carbohydrate.

Focus has now shifted from the erythroid cell physiology to the interaction of iron with liver cells. Isolated rat hepatocytes were prepared and incubated with various forms of iron: ferric iron-citrate complex, ferrous iron, and transferrin-bound iron. Using the Michaelis-Menten kinetic approach, it was found that ferrous iron uptake was fastest, but the iron was taken up by a simple diffusion process. The uptake of ferric iron was slower,

and showed saturation kinetics. Transferrin-bound iron was taken up the slowest, and this also showed saturation kinetics. The uptake of transferrin-bound iron was increased when the collagenase solution used for the perfusion of the rat liver contained soy-bean trypsin inhibitor. This finding prompted us to postulate that the uptake of transferrin-bound iron by the liver involves the interaction of the iron-transferrin complex with the specific receptor on the hepatocyte cell surface. It would appear that the uptake of iron by the hepatocytes is not unlike that of reticulocytes.

Humoral Regulation of Liver Cell Growth: Humoral factors, including known hormones such as insulin, glucagon, and hydrocortisone are capable of affecting the rate of DNA synthesis in hepatocytes and may be involved in the regulation of liver cell growth.

The present studies represent an extension of previous work in which an identified heat-stable nondialyzable polypeptide RF₁ was found in the serum of rats following partial hepatectomy that was specific for stimulating DNA synthesis in hepatocytes.

Specific immediate aims were 1) to study the role of the hormones, insulin, glucagon, and hydrocortisone on adult liver cell proliferation in culture, and 2) to study the effect of RF₁ on ornithine decarboxylase (a possibly growth regulatory enzyme) and tritiated thymidine uptake into DNA in cell cultures of adult hepatocytes.

A primary monolayer hepatocyte culture system has been established that enables both normal and regenerating rat liver cells to be maintained in culture with a viability of over 80% for 5 days. This cell culture technique was used in the assay of serum factors and hormones involved in the initiation of DNA synthesis and cell proliferation *in vivo*.

Cells isolated from a rat liver 12 hours after partial hepatectomy before the same of onset (14 to 16 hr.) of DNA synthesis *in vivo* would not enter DNA synthesis in culture. Cells isolated during the period of active DNA synthesis *in vivo* (24 hours post partial hepatectomy) continue that round of DNA synthesis *in vitro*.

It therefore appears that regenerating cells must be committed to or already in the S phase of the cell cycle *in vivo* in order to undergo DNA synthesis in culture. The role of the factors that initiate DNA synthesis in hepatocytes now can be determined using this cell culture system. The latter population in particular would be expected to be sensitive to the addition of hormones or other agents that are normally missing in the culture situation but are present *in vivo*.

Using normal liver cells in culture for up to 5 days we have tested the effect of hormones on the initiation of DNA synthesis. The combination of insulin and hydrocortisone significantly increases the extent of DNA synthesis in these cells. In contrast, we have been unable to show any effect of these hormone combinations on 16 to 17 hour regenerating liver cells even over a period of 48 hours in culture.

Cerebral Decline in Aging: The effects of aging on the dynamic metabolic process of brain tissue have not been clarified for the human or any other mammalian species. One difficulty has been distinguishing the effects of age-related abnormal cerebral circulation from those of abnormal cerebral metabolism. The circulation effects are being circumvented by studying the metabolic performance of isolated brain tissue (slices), using mice (CBF₁) as the animal model. It has been observed that there is significantly less oxygen uptake and ¹⁴CO₂ production in old (ca. 34 months) as compared to young (ca. 6 months) mice in brain slice incubations utilizing ¹⁴C-glucose as the energy source. In this ongoing project attempts are being made to identify the reactions that underly the effects found in tissue of aging animals. Being measured is the time course of formation of energy metabolites and key intermediates of carbohydrate and amino acid metabolism in brain slices of young and aging animals. Attempts are being made to locate the defective sites in aging tissue by employing energy sources that feed into carbohydrate metabolic pathways at different levels. Also, we will measure the synthesis of selected neurotransmitters in brain slices

derived from the young and old animals in an attempt to correlate their dynamic metabolism with the dynamic metabolic state of the tissue. Selected correlated *in vivo* experiments are being done to validate the results. All tissues studied are being characterized with respect to the presence and concentration of lipofusein, RNA, and DNA to enable their correlation with the metabolic abnormalities found. The study will provide clues as to how the metabolic defects give rise to functional abnormalities. It is anticipated that the study will contribute to the understanding of mental dysfunction in aging humans and may suggest new ways to treat the elderly.

Study of Plasminogen Activators: The fibrinolytic mechanism is one of the last lines of defense against the permanent occlusion of blood vessels by fibrin thrombi. The endothelial cell layer of vessels is thought to be the source of a plasminogen activator that 1) maintains a normal level of activator activity for the lysis of fibrin that arises from physiological activation of the coagulation

mechanism by minor trauma, and 2) is released in larger amounts in response to blood vessel injury and the formation of fibrin thrombi. This plasminogen activator has been isolated from pig heart in a highly purified state. However, when it is compared to the plasminogen activating potential of urinary urokinase, the activation of purified human plasminogen is much less rapid and complete than that achieved with urokinase. Recent studies have shown that another protein is essential for rapid activation. This protein, which is non-enzymatic, accelerates activation of plasminogen by tissue activator and has been termed accelerator protein (AP). During purification of activator, AP is apparently dissociated from activator, resulting in an activator of low proteolytic and esterolytic activity. Recombination of AP and activator results in a partial regain of proteolytic and esterolytic activity. Studies are continuing to determine the physico-chemical properties of AP and its physiological role in the fibrinolytic mechanism.

Educational Activities

Members of the Biochemistry Department participate in basic science and medical education programs within the department and in conjunction with interdisciplinary programs. This participation takes place at many levels of education, including undergraduate and pre- and post-doctoral programs. The department participates in the teaching of basic and applied medical biochemistry to medical students of Rush Medical College during the three phases of the curriculum; the training of medical technologists in clinical chemistry in the Medical Technology Pro-

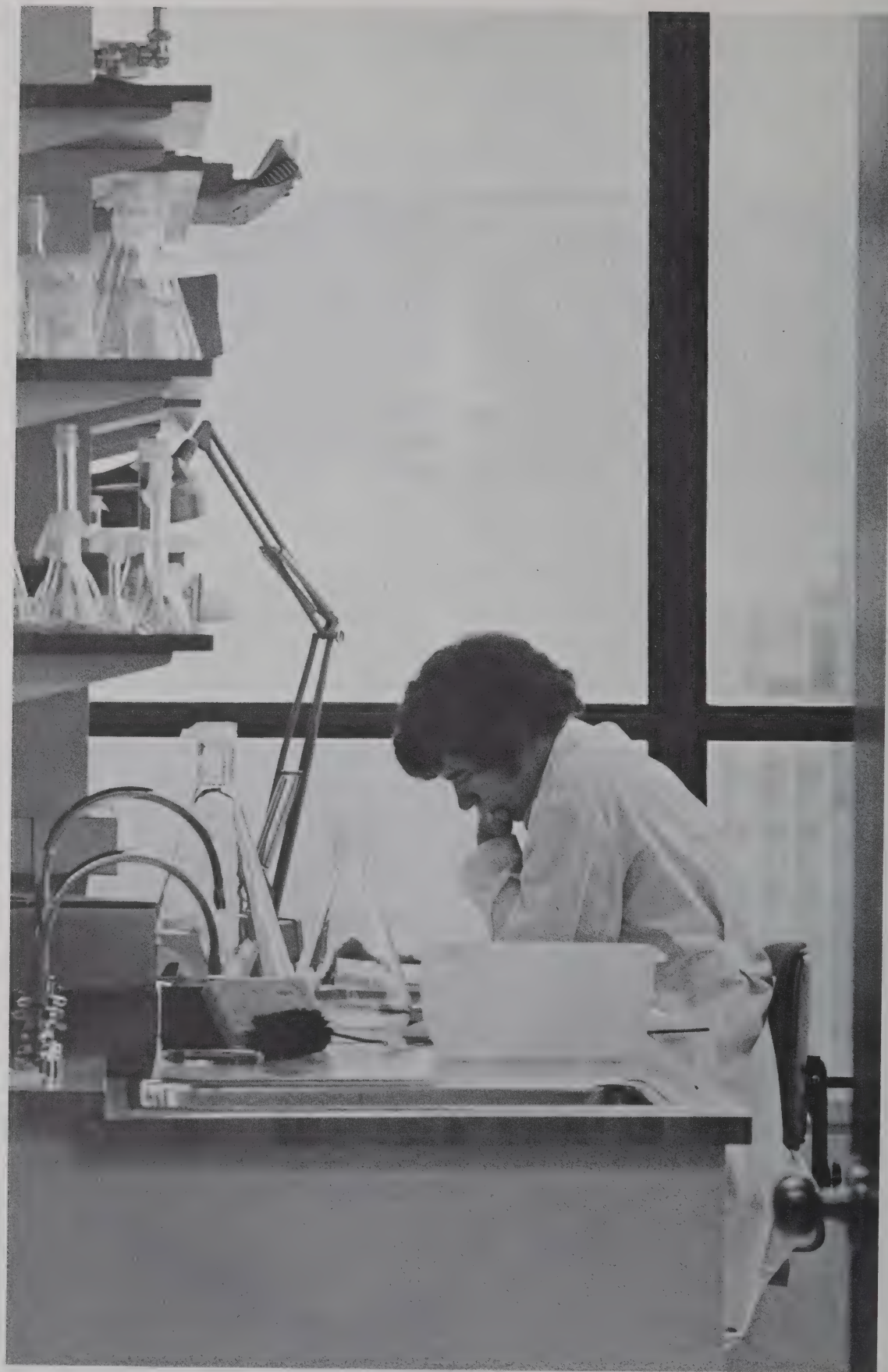
gram of the College of Health Sciences; and the education of graduate students leading to a doctor of philosophy degree in the Graduate School. The department also utilizes the facilities of the clinical biochemistry laboratory and research laboratories in the training of medical, basic science, and post-graduate students. Since the clinical laboratory is one of the most active up-to-date laboratories in the country, it provides opportunity for the teaching of medicine and for the training of clinical chemists. In addition, the department participates in seminars, rounds, and multidisciplinary training programs.

Service Activities

The clinical biochemistry laboratory is a modern, automated, computerized, high-volume medical service facility performing approximately 1,700,000 individual chemical tests per year. These include some 250 different biochemical tests from the more simple electrolytes, carbohydrates, and fats to the more complex proteins, metabolites, and drugs. The objective of the clinical laboratory is to provide the most efficient, accurate, and extensive patient service obtainable. To

accomplish this, the laboratory is continually studying the development of its automated and computerized facilities, quality control programs, methodology, and on-the-job training of personnel. Finally, it is the objective of the members of the clinical biochemistry laboratory that the facilities be used for the development of medical research, not only for patient services; as a teaching tool for medical students, house staff, and graduate students; and for a better understanding of human biology at the clinical level.





Department of Immunology

Henry Gewurz, M.D., the Thomas J. Coogan, Sr., M.D., Chairperson

Faculty

Cunningham, C.	Golden, H.	Luskin, A.	Siegel, J.
DiCamelli, R.	Hansen, B.	Merkel, F.	Suyehira, L.
Fiedel, B.	James, K.	Osmand, A.	Zeitz, H.
Gewurz, A.	Jones, J.V.	Potempa, L.	
Gewurz, H.	Lint, T.	Sasseti, R.	

Research Activities

The primary investigative interests of this department include: the immunobiology of the inflammatory response; immune reactions of cells and membrane; the clinical, developmental, and experimental biology of the effectors of the immune response, particularly cell-mediated mechanisms in inflammation; the immunopathology of coagulation; the chemistry, biology, and clinical relevance of C-reactive protein and the acute phase response, and their interrelationships with the immune systems in health and disease. The

application of basic research to questions of human health in disease is a major area of emphasis. This involves the innovation and implementation of new approaches that utilize analysis of the immune status and immunoassays to aid in the rapid diagnosis and treatment of disease, and analysis of individual patients and groups of patients with unique primary or secondary abnormalities or aberrations of the immune systems. The department is well equipped with both teaching and laboratory facilities for research in experimental and clinical immunology.

Educational Activities

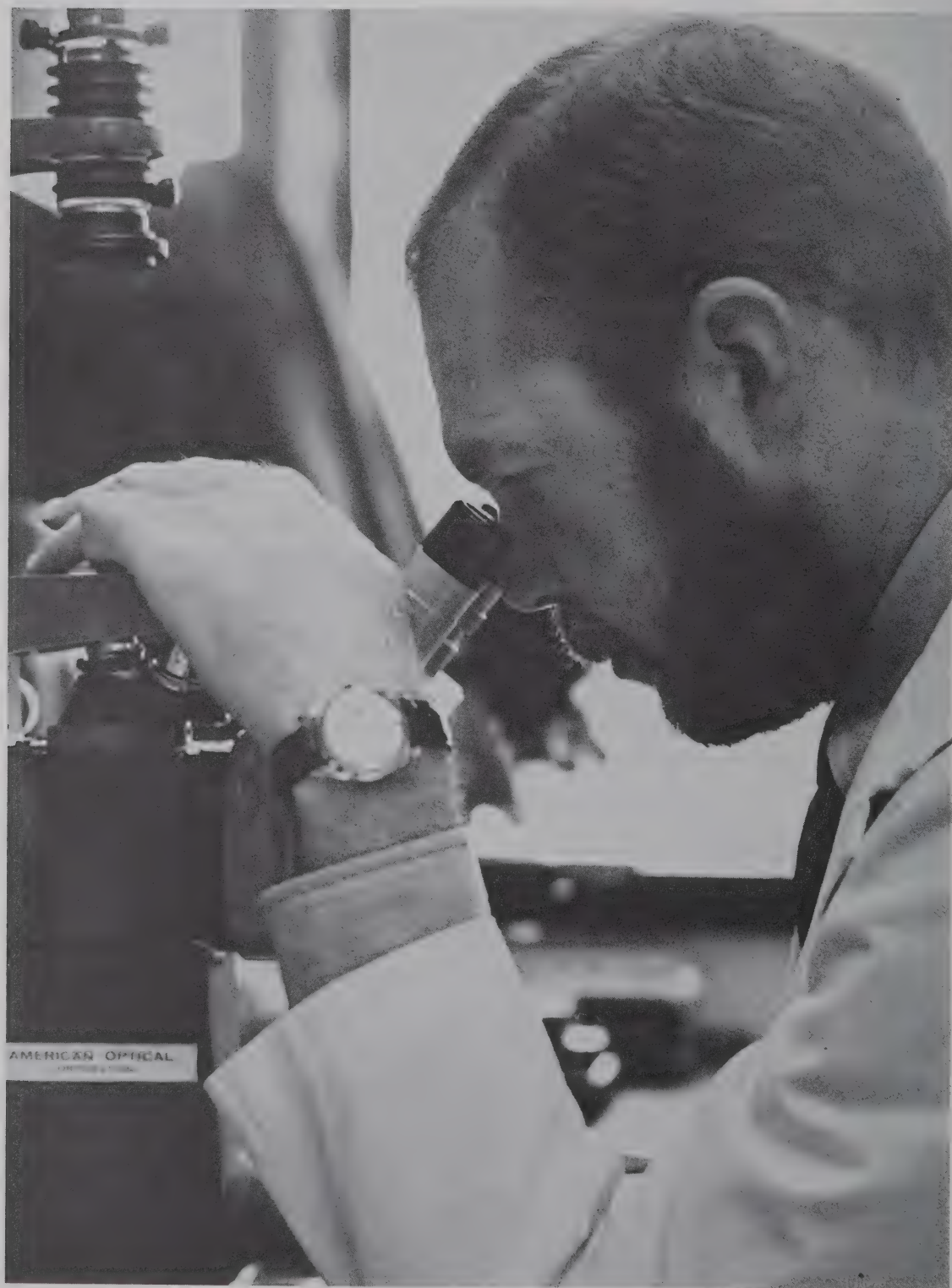
The department offers courses in basic immunology, allergy, and clinical immunology to medical, graduate, and related health science students, and postgraduate courses in allergy and clinical immunology to house staff and faculty. Weekly research seminars, clinical conferences, journal clubs, and ward rounds are held. Eleven graduate students

currently are preparing for the Ph.D. degree. A student research program has involved upwards of ten medical and undergraduate students during the summer, and upwards of six individuals during the year. The department generally has two to four postdoctoral fellows training in basic and clinical immunology, and a training program in allergy and immunology is under development.

Service Activities

The clinical immunology laboratory provides patient services that include (a) assays to measure the competence of the immune system and the presence and nature of given immune-mediated diseases, disease pro-

cesses, and host responses; and (b) the use of immunologic methods to quantify host proteins as well as certain medications. Patient care and consultative services in allergy and immunology are an integral part of the departmental activities.



Department of Microbiology

Lauren G. Wolfe, D.V.M., Ph.D., Acting Chairperson
William Landau, Ph.D., Director, Section of Bacteriology

Faculty

Baram, P.	Goldin, M.	Marczynska, B.	Shaffer, J.
Bergholz, C.	Goodheart, C.	McQuay, R.	Welsh, T.
Casto, B.	Hatch, G.	Northrop, R.	Widra, A.
Deinhardt, F.	Jones, I.	Ogden, J.	Wolfe, L.
Falk, L.	Kaplan, R.	Patterson, R.	
Fisher, L.	Landau, W.	Peterson, D.	
Gavitt, F.	Levin, S.	Schuytema, E.	

Research Activities

The research program includes studies of viral and chemical carcinogenesis, viral hepatitis, slow (virus) infections, persistent rubella virus infections, periodontal disease, and methodology in diagnostic microbiology.

Carcinogenesis: Oncogenic RNA viruses (oncornaviruses) and lymphotropic herpesviruses of primate origin are evaluated for transforming potential *in vitro* and oncogenicity *in vivo*. Cell susceptibility, mechanisms of transformation, and viral gene expression are investigated *in vitro*. Attempts to isolate or identify oncogenic viruses from spontaneous human and nonhuman primate tumors are pursued. Eight experimental tumor models (3 sarcoma, 1 glioma, 4 lymphoproliferation) have been established in marmoset monkeys and selected models are investigated from the standpoints of pathogenesis, viral gene expression, host immune response, and efficacy of therapy or prevention. Studies of chemical carcinogenesis and viral-chemical co-carcinogenesis in primate cells are under way.

Viral hepatitis: Experimentally-induced hepatitis A and non A-non B hepatitis are studied in marmosets. With non A-non B hepatitis attempts are under way to identify the etiologic agent(s) and to identify specific antigenic and serologic markers of infection. Cell cultures are examined for susceptibility to hepatitis viruses.

Slow (virus) infections: Kuru and Creutzfeldt-Jakob disease were transmitted to marmosets and studies of pathogenesis continue. Pathogenicity of mutant or defec-

tive measles viruses is studied in nonhuman primates, the aim being to develop a model of subacute or chronic CNS disease induced by measles virus.

Persistent rubella virus infections: Studies are under way to test the hypothesis that persistent latent infection with rubella virus plays a role in the etiology of some forms of rheumatoid arthritis. Antibodies to rubella virus were significantly elevated in a small sample of rheumatoid patients, and a cell membrane antigen that may be specified by the rubella virus genome was detected on rheumatoid synovial cells by cytotoxicity tests with monospecific rubella virus antiserum.

Periodontal disease: The microbial components of subgingival plaque associated with various stages of periodontal lesions are studied. Emphasis is placed on the analysis of end products of organisms and definition of the bacterial products associated with pathogenicity.

Clinical microbiology: Developmental research in clinical microbiology is aimed at development and/or refinement of diagnostic methods for use in the diagnostic bacteriology and virology laboratories.

The research laboratories are well equipped for biological and biochemical research. Through the courtesy of the city of Chicago and the Chicago Board of Health, space is provided at the Municipal Communicable Disease Hospital for maintenance of a marmoset colony (approximately 1,000 animals) and for laboratory support.

Educational Activities

Diagnostic procedures and clinical background in bacteriology, virology, mycology, and parasitology are presented to medical technology students.

Classification, characteristics, laboratory identification, and pathogenicity of infectious agents are presented to medical and graduate

students. The opportunity to experience laboratory work in diagnostic bacteriology, diagnostic virology, and virus serology is provided.

A three-month rotation through the diagnostic bacteriology and virology laboratories is available as part of the residencies in internal medicine, surgery, and pathology.

Service Activities

Bacteriological diagnosis, identification of fungi and parasites, virus isolation, and serol-

ogy are performed in the diagnostic microbiology laboratories in support of patient care.



Department of Pharmacology

Paul E. Carson, M.D., Chairperson

Donald S. Ebersman, Ph.D., Director, Section of Pharmaceutical Sciences

Henri Frischer, M.D., Ph.D., Director, Section of Blood Genetics and Pharmacogenetics

Faculty

Carson, P.	Gdalmann, L.	Nausieda, P.	Prancan, A.
Ebersman, D.	Klawans, H.	Nootens, R.	Rieckmann, K.
Ecanow, B.	MacLeod, C.	Parkhurst, G.	Trenholme, G.
Frischer, H.	Moon, B.	Powers, R.	

Research Activities

Research is being conducted on the pharmacokinetics of drugs, to determine if individual drug response is of genetic origin, is acquired, or caused by interaction with other drugs or their metabolites. This work requires continued development of methods for measuring drugs in the blood, urine, and other body fluids or tissues. This approach also will require ascertaining the pharmacology profile of individuals in terms of the activities of those reactions known to change drug metabolism, such as fast and slow acetylation, variation in detoxifying enzymes, or variations in enzymes such as G6PD deficiency that alter the response to drugs. In this context investigation of cellular metabolism especially of red cells as affected by drugs and the metabolites of drugs is being conducted not only in terms of the enzymic pathways of the cells but also in terms of membrane effects of the cytoplasmic enzymes.

Research being conducted by the Section of Blood Genetics and Pharmacogenetics includes the investigation of hereditary blood disorders with particular emphasis on the detection, physiopathology, host-drug interactions, and treatment of those with red cell enzymopathies or hemoglobinopathies.

In the field of neuropharmacology, research is being conducted on the pharmacology and biochemistry of animal models of human movement disorders coupled with investigations into the mechanism of action of drugs used in the therapy of neurologic and psychiatric disorders.

Other areas under active investigation include the clinical pharmacology of the aminoglycosides, the role of prostaglandins in endotoxin shock and in platelet aggregation, and the relationship of "tranquilizing" agents used in anesthesia to the analgesia induced by opiated derivatives.

Educational Activities

At present the Department of Pharmacology is responsible for teaching the sequence in medical pharmacology to students in Rush Medical College and basic pharmacology to the students in the College of Nursing. The course in medical genetics for the Rush Medical College is provided by the Section of

Blood Genetics and Pharmacogenetics. The faculty provides elective experience in clinical pharmacology for the third and fourth year medical students. Within the department, the Division of Pharmacology instructs graduate students in a program leading to the Ph.D. degree in pharmacology in the Graduate School of the College of Health Sciences.

Service Activities

Laboratory service includes determinations and the development of determinations of blood, urine, and tissue levels of drugs being prescribed to the patient population of the Medical Center. Laboratory services also are provided to improve detection and management of inherited blood disorders and drug-induced disturbances. The Section of Pharmaceutical Sciences includes the Medical Center pharmacy system, i.e., the hospital pharmacy, satellite pharmacies, and the

pharmacies of the Sheridan Road Pavilion and the Johnston R. Bowman Health Center for the Elderly. Clinical pharmacology and pharmacy programs are currently being developed in conjunction with the laboratory to provide consultation for better patient care and to further improve patient care through the development of additional programs for drug surveillance and drug reactions and continuing education for medical students, house staff, nurses, pharmacists, and attending staff.



Department of Physiology

Robert S. Eisenberg, Ph.D., the Francis N. and Catherine O. Bard Chairperson

Faculty

Agarwal, G.	Eisenberg, B.	Kootsey, J.	Milner-Brown, S.
Barclon, V.	Eisenberg, R.	Levett, J.	Pencek, T.
Brueschke, E.	Giuffre, V.	Levis, R.	Rovick, A.
Bullock, J.	Gottlieb, G.	Lewis, C.	Schauf, C.
Cohen, F.	Hegyvary, C.	Mathias, R.	
Donaldson, S.	Heyer, C.	Michael, J.	

Research Activities

Physiology is the study of function and mechanism of function of the various components of plants and animals. Physiological questions are asked of tissues at every level of structural complexity, ranging from questions of human behavior (how does a conscious human control the position of his foot?), to questions of the physics of ion movement (how does an ion cross a membrane 80Å thick?). Such physiological questions, if intelligently asked, have direct relevance to practical issues of health and disease because some disease processes depend directly on the function of both gross and submicroscopic structures. Physiological questions have a unity because the methods of describing and analyzing function are *not* diverse, even if the structures performing those functions are. For example, the mathematics describing the flow of several ions across membranes is intimately related to the mathematics describing the control system that governs the movement of the foot.

The unity of physiology arises then from the questions it asks. The diversity of physiology arises from the systems about which those questions are asked. The fun of physiology arises from the tension between its unity and its diversity. One never knows when the diversity (in the form of a new system being studied) will require new questions; questions when applied to previously studied systems are at least as revealing as when applied to the new system itself.

Considerable effort is spent in the department studying membrane phenomena since so much of the function of animals is directly traceable to the function of their membranes. Work is being done on the physics of ion transport across artificial membranes, which mimic the structure of the simpler parts of biological membranes. Work is also being done to extract the functionally important

parts of biological membranes and place them into artificial membranes in which their biological functions will be directly accessible to the powerful techniques of physical and chemical analysis. The three membrane processes best understood today are the mechanism of ion transport across the membranes of red blood cells, the mechanism of ion movement that produces the electrical signalling within one nerve cell, and the mechanism of ion movement that allows one nerve cell to 'talk' to another. Significant research efforts are underway in each area.

The molecular properties of the transport system that maintains the volume of red blood cells and allows them to exchange oxygen with tissues are being examined with the use of pharmacological probes, digitalis, and related compounds. The mechanism of ion movement across nerve membranes is studied by controlling the driving forces across those membranes (namely, voltage and concentration) and examining the resulting currents. Such studies are underway in giant axons of marine worms (in which molecular questions can be asked) and in the more complex giant nerve cells of snails (in which processes well defined in molecular terms are being sought). The processes in axons of marine worms are essentially identical to the signalling processes in mammalian nerve fibers; the processes in nerve cells of snails are essentially identical to processes in various mammalian nerve cells. The mechanism by which one nerve communicates with another depends on the mechanism by which chemicals (e.g. numerous clinically useful drugs) influence voltages across membranes. The molecular architecture of the chemical receptors of nerve cells is being studied by recording the interaction of *single molecules* of drugs with those receptors. This latter work has already shown that the questions historically asked

are poorly posed; it is now formulating its own questions, which undoubtedly will be immediately asked of nerve cells and pharmacological receptors in general.

As appealing as are the molecular questions just described, they clearly cannot be asked of all systems. Before a molecular question can be well posed, it must be clear how a single molecule is involved in the function of interest. Much of the work in the department is designed to isolate those systems that underlie fairly complex function and to isolate those systems in such a manner that it is sensible to ask molecular questions. For example, the molecular mechanisms that underlie the signalling system of skeletal muscle, cardiac muscle, and probably smooth muscle, are hidden from experimental view in membranes deeply enfolded within the muscle cells. It is worthwhile to isolate the molecules of the signalling system because those molecules are responsible for much of the function of the system, and for many of the failures of the system in disease (e.g. in muscular dystrophy). Molecular systems can be isolated only after a systematic procedure that examines the structure of the tissue, using quantitative anatomical techniques, that predict the properties expected from those structures, and using mathematical techniques that confront those predictions with the actual measured properties of the tissue. This procedure is being applied to skeletal muscle, cardiac muscle, and the lens of the eye.

The behavior of more complex structures is being pursued as well. The processing of

visual information in the retina is being examined in normal and pathological situations. The control of movement in conscious humans is amenable to a surprisingly precise and simple analysis. This control mechanism is being extensively investigated and the results applied to predict the movement of the foot under a variety of conditions.

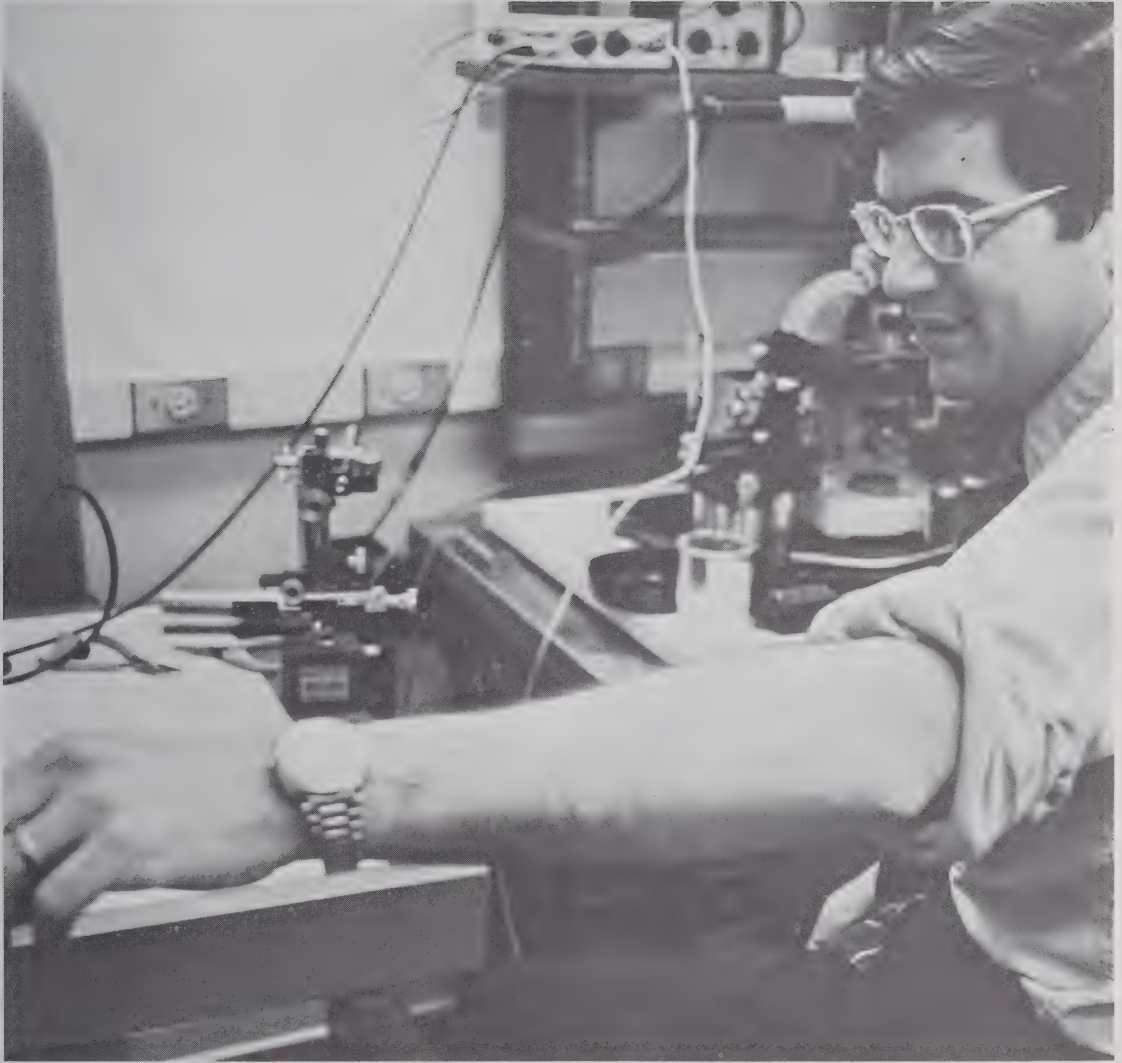
The flow of blood and the resulting oxygenation of tissue is central to the function of all mammalian systems. Here simple questions of surprising importance have not been answered and are being asked in the department. How does the circulatory system protect the animal from the effects of turbulence, with the concomitant energy losses and damage to red blood cells? Is the branching pattern of the circulatory system designed to minimize such turbulence? How well does the circulatory system maintain the oxygen levels required by the brain? What are the effects of circulatory failure on the neural activity of the surrounding tissue?

Physiology is successful if it can describe and analyze such a diversity of systems within a reasonably circumscribed set of procedures. If successful, physiology can tell how tissues and cells perform their biological task and thus it can tell how to repair those tissues and cells if they fail because of disease. To teach the principles of physiological function is our goal in teaching medical, nursing, and graduate students.

Educational Activities

The Department of Physiology is responsible for providing instruction to all university students requiring instruction in physiology to fulfill their degree requirements. In medical physiology, for example, instruction is provided for approximately 150 medical and graduate nursing students, as well as a com-

parable number of undergraduate nursing students. In addition, in concert with the Graduate Division of Physiology, a variety of courses dealing with the electrical properties of cells and tissues, neurophysiology, active transport, cardiovascular physiology, and applied mathematics is offered to graduate students.





Department of Psychology and Social Sciences

Rosalind D. Cartwright, Ph.D., Chairperson

Frank Leavitt, Ph.D., Director, Section of Psychology

Michael A. Counte, Ph.D., Acting Director, Section of Social Sciences

Faculty

Bieliauskas, L.	Feldman, H.	Lindner, R.	Pavlou, M.
Brocken, C.	Funk, J.	Linsky, M.	Pisani, V.
Cartwright, R.	Garron, D.	Lipoff, D.	Psarras, G.
Cheifetz, D.	Guise, G.	Lipgar, R.	Schevers, T.
Christman, L.	Hartings, M.	McNamara, B.	Schneider, A.
Clark, D.	Hegyvary, S.	Martin, D.	Schoenenberger, J.
Counte, M.	Kasznik, A.	Mead, J.	Stephens, A.
Dawkins, M.	Kelly, M.	Miller, R.	Ulrich, L.
Driscoll, P.	Kooker, K.	Moncrieff, E.	Watson, L.
Exum, D.	Leavitt, F.	Padonu, G.	Wilson, R.

Research Activities

The Department of Psychology and Social Sciences is increasingly involved both in basic research with eventual relevance to health care concerns and in research more immediately applicable to the development and evaluation of clinical practice. These various studies are being carried out independently and in collaboration with other departments and clinical services.

There is an active area of research in sleep and dream disorders in clinical groups. One ongoing study is attempting to work with the dysfunctional dream patterns of depressed women. Other studies address the question of dream function in the normal and the variations in dream patterns among individuals with differing life styles during waking, e.g., artists versus accountants.

There is a program of studies generally concerned with the neuropsychology of aging. Central to this program is a systematic study concerning the effects of cognitive function of both normal and pathological aging (presenile dementia). This study has shown that attention is relatively unimpaired during the normal aging process, although learning ability and recent memory become less efficient. In pathological aging, as indicated by cerebral atrophy, both attention and memory are impaired. An immediate practical result of this study is the validation of a cognitive and mental status examination for use in the diagnosis of generalized dementia and focal intellectual deficits. Related studies in this program include pre- and post-operative cognitive and intellectual evaluation of persons undergoing carotid endarterectomy; the relationships between cognitive deficits, liver disease, and cerebral atrophy in alco-

holism; and the relationship of dementia to both electroencephalographic abnormalities and cerebral atrophy.

Another group of studies is concerned with the investigation and validation of behavioral approaches to the management and treatment of common clinical problems, such as headache and other pain and neuromuscular symptoms, hypertension, and spastic dysphonia. Of most promise is the investigation of the initial success in the use of biofeedback techniques in enhancing motor recovery following stroke.

Continuing studies of patients with low back pain indicate that there are seven independent components of such pain. Using these components, it may be possible to differentiate between patients with and without positive physical findings. Application of these findings to the clinical setting seems feasible.

A group of persons with Turner's syndrome, probably the largest and most representative such group, is being followed in behavior and genetic studies of intelligence and personality. There is no increased incidence of either mental retardation or emotional disturbance, but a perceptual deficit and a lack of self-assertion are characteristic from early childhood. Current studies involve the identification of a common base for the affected cognitive and personality traits.

A new study has begun, in conjunction with the Multiple Sclerosis Center, concerned with the behavioral adaptations of persons with multiple sclerosis, and their attitudes toward medical care.

There is a program of studies concerned with the behavioral correlates of cardiovascular disease. The current study investigates

relationships between personality factors and both concurrent risk and subsequent morbidity and mortality from coronary heart disease.

One group of studies concerns children's difficulties, the family context in which these difficulties appear, and ways of managing these difficulties. There is also a collaborative study on attachment and feeding procedures, and another concerned with the effect on neonates' subsequent development of maternal and prenatal lead exposure.

Finally, there are various studies of factors affecting health and health care being carried

out in the department. These studies are concerned with the development of methods to monitor and evaluate nursing care, with the social epidemiology of diabetes, and with the effects of physician appearance on patient attitude.

The department has its own research laboratories equipped with three-channel tachistoscope, eye-movement camera, flicker fusion apparatus, psychomotor apparatus, high-speed computer facilities, a variety of biofeedback equipment, and a five-bed unit for the all night recording of EEG during sleep.

Educational Activities

The department has major responsibility for a curriculum of instruction in behavioral sciences for undergraduate medical education. The curriculum includes fundamental concepts and vocabulary, basic interviewing and relationship skills, human development and behavioral pathology, and a series of special topic seminar courses in areas of interface between behavioral science and medical specialties. The curriculum is intended to prepare the student physician for the psychological, social, and behavioral aspects of patient care.

The department offers a one-year internship in clinical psychology, approved by the American Psychological Association, in fulfillment of the internship requirement of university doctoral programs in clinical psychology. Five elective options are offered, which permit specialization in general clinical psychology, neuropsychology, child psychol-

ogy, health care psychology, and community psychology. Intensive, supervised training is provided in the skills and functions that clinical psychologists are called upon to perform in most settings. Third and fourth year doctoral students are eligible for appointment. Training includes diagnostic assessment of the adaptations of adults and children and of events that have impact on adaptation. Emphasis is placed upon understanding the psychological and behavioral accompaniments of medical illness. Training encompasses psychotherapeutic and behavioral intervention, patient management, and skills.

Two post-doctoral research fellowships are offered: one in clinical human neuropsychology, the other in sleep. These are open to individuals with a doctoral degree in psychology. This program provides advanced training in neuropsychological assessment and human skills, and an opportunity to develop an area of research in either area.

Service Activities

Within the Section of Psychology eight programs of patient care can be described: the Diagnostic and Therapeutic Service, the Neuropsychology Service, the Office of Behavioral Studies, the Pediatric Psychology Program, the Sleep Disorder Service, the Children's Day Hospital and School, the Multiple Sclerosis center, and the Community Psychology Program.

Diagnostic and Therapeutic Services: The Section of Psychology is particularly active in the development and delivery of health care services in the Medical Center. Consultation

on the traditional psychological, psychiatric, and neuropsychological conditions is provided throughout the Medical Center. Specific diagnostic and consultation services are also provided in areas of pain, aging, chronic disease, rehabilitation, psychosomatic problems, sleep difficulties, tension states, cognitive and emotional changes in persons undergoing medical treatments, and problems in patient management. As part of this approach, both traditional and innovative treatment approaches are offered. The department serves as an active referral resource for problems ranging from somatic

complaints without physical findings to more acute disturbances seen in relation to medical trauma. Treatment for such persons in addition to traditional ambulatory outpatient care, includes behavioral management, short-term counseling and psychotherapy, and crises intervention, as well as involvement in the family system. This type of consultation and treatment is marked by close interdisciplinary collaboration with physicians and other support services.

Neuropsychology Service: The Neuropsychology Service provides consultation on the psychological sequelae of disorders of the central nervous system and contributes to the management of affected patients. Clinical and research activities are collaborative as well as independent, involving studies of aging (presenile and senile dementias), specific diseases (disease of the basal ganglia, etc.), and other conditions affecting behavior (e.g., stroke, toxic states, epilepsy, psychopathologies).

Office of Behavioral Studies: The Office of Behavioral Studies is an evaluation, treatment, and referral source for complicated medical/psychosomatic problems. Its programs combine newer psychological technologies such as biofeedback and relaxation with traditional psychotherapeutic methods such as behavioral management, brief psychotherapy, and staff consultation and bring these to bear on complex health problems. A wide range of medical conditions is seen that often is not amenable to cure through the application of medical regimens. Such conditions include chronic tension, chronic headache, pain disorders of various etiologies, neuromuscular disorders, hypertension, asthma, GI distress, speech disorders, and post-CVA conditions. Patients with arthritis, lung disease, and other chronic conditions are seen in consultation to help identify and facilitate adaptational changes. The staff maintains close working relationships with other disciplines in the medical setting and patient management is typically in an interdisciplinary program.

Pediatric Psychology: Pediatric Psychology is a program of psychological services, consultation, teaching, and research orga-

nized within the Department of Pediatrics. The staff of four child psychologists provides diagnosis and therapeutic services to children from birth to 18 years of age and to their families. Patients are both medical inpatients and outpatients who present problems ranging from the more traditional areas of child psychopathology such as difficulties with school or family, to management of problems resulting from acute to chronic illness. Preventive intervention is emphasized and developmental evaluations and other screening procedures are frequent referral requests. Therapeutic strategies are based on conceptualizing problems in individual and interactional terms using a variety of theoretical frameworks. The active focus of therapy includes the entire family, family subgroups, and the individual.

Sleep Disorder Service and Research Center: This service has the capacity to diagnose and treat persons suffering from difficulties with falling asleep, staying asleep, early morning awakening, sleep attacks during waking, and other difficulties associated with sleep such as sleepwalking, nightmares, etc. Patients will be housed overnight in a new five-bedroom unit while their sleep is monitored throughout the night. Treatment programs are varied according to the diagnosis; individual psychotherapy, relaxation and biofeedback, and behavioral management are some of the methods available.

Children's Day Hospital and School: This program, staffed largely by child psychologists with joint appointments in the Department of Psychiatry, offers year-round day treatment to children, ages 4 to 13, who have serious difficulties adjusting at school or at home and who therefore do not profit from the usual neighborhood school experience. With an average enrollment of 45 children, the program provides a comprehensive focus on the child through educational, social, psychological, and family services, while maintaining the child in his home and community setting. The primary objective of this program is to provide the necessary educational help and comprehensive therapeutic intervention to reintegrate the child into a regular school set-

ting within a period of two years. Individual and group psychotherapies are provided for children; family therapy is preferred for the families of these children. Psychologists provide program administration and direction, diagnostic assessment, psychotherapy, and consultation, in collaboration with social workers, special educators, occupational therapists, nurses, psychiatric residents, psychology interns, pediatric residents, and psychiatric consultants. The ongoing program, staff, activities, and physical setting constitute a milieu that provides a model of open, healthy, interpersonal interactions.

Multiple Sclerosis Center: In this comprehensive diagnostic and treatment center for persons with multiple sclerosis, the clinical skills of neurologists and psychologists are combined to provide medical diagnosis and management as well as behavioral and psychological evaluation and intervention. Psychologists provide for individual assessment of each patient's personal and adaptational status and relate this to programs of individual, marital, family, and group counseling. Educational and adjustment programs of the center form the principle mode of behavioral intervention, directed towards the normal individual undergoing unusual long-term stress.

Community Psychology: Psychologists on the staff of the Mile Square Health Center hold faculty appointments in this department. These psychologists are primarily responsi-

ble for a program of community mental health services including Sustaining Care Programs, Community Day Treatment Programs, Outpatient Diagnostic and Therapeutic Services, Diagnostic Services for Developmental Disabilities, and Work Release Programs. A multidisciplinary staffing pattern and team approach are seen as essential in providing quality service in diagnosis, treatment, psychosocial, and vocational needs of community patients. Outpatient programs address the needs of children and adults, including a crisis intervention program to provide immediate resources for individuals in crisis. A school psychologist provides special corrective and preventive programs for the early detection and remediation of developmental, educational, and learning disabilities. An art therapy program provides alternate modes of expression for elementary school children in special adjustment classes. A weight control program is conducted in collaboration with the Department of Medicine, utilizing relaxation and behavioral techniques in managing and eliminating over-eating. With the Department of Obstetrics and Gynecology a program for the care of young pregnant women who show signs of emotional disturbance has been developed. Thus, programs provide direct care and treatment for mentally ill individuals, and also include new multidisciplinary programs targeted to the health care needs of a variety of underserved populations.



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Department of Health Systems Management

Bruce C. Campbell, M.H.A., Acting Chairperson

Faculty

Anderson, T.	Esmond, T.	King, J.	Rothstein, R.
Andriacchi, T.	Freeman, C.	Lerner, W.	Shirk, M.
Bass, G.	Freeman, J.	Maher, J.	Sinioris, M.
Block, A.	Freund, L.	McNulty, T.	Thompson, L.
Bradley, W., Jr.	Glessner, M.	Oder, D.	Tighe, J.
Brownlee, E.	Hausman, D.	O'Shea, J.	Trufant, J.
Campbell, B.	Inns, J.	Paul, H.	Warden, G.
Cort, L.	Jelinek, R.	Petry, H., III	Weir, S.
Crane, E., Jr.	Kaatz, G.	Reynolds, R.	Ziesler, R.
DuFour, R.	Kerr, J.	Roach, W., Jr.	Zimmerman, R.

The Department of Health Systems Management was formally established in 1975. The department's goals are: 1) to provide a graduate program for health systems managers; 2) to provide residency training and continuing education for health systems managers; and 3) to develop and apply research to improve the health delivery system.

The faculty consists of practicing administrative and systems professionals who

teach and advise students in areas based upon actual management responsibility held by the faculty in the Medical Center. Faculty members function in diverse roles in administration, management consulting, finance, law, and data processing. Educational and research programs are directed by faculty members working within health systems who apply as well as profess their knowledge.

Educational Activities

The Graduate Program In Health Systems Management

The Health Systems Management Program at Rush University is a graduate professional program designed to train individuals for careers that will focus on the major problems facing one of the nation's fastest growing industries. Graduates will be prepared to work with physicians, health scientists, nurses, hospital administrators, health planners, and others concerned with controlling costs, improving quality, and increasing the overall effectiveness and efficiency of the health care delivery system. Career possibilities for graduates are widely distributed among a variety of health systems and management-related positions. These include management/staff positions within a single hospital or multi-hospital systems in the private sector; management/staff positions within a Veteran's Administration, Public Health Service, or other public health sector facility; health systems research or devel-

opment; management/staff positions in a consulting firm specializing in the improvement of the health care delivery system.

The Health Systems Management Program's approach takes students from a wide variety of academic backgrounds and provides a strong foundation in health care management and system/industrial engineering through the traditional didactic avenue and through a unique, practical, educational experience at Rush-Presbyterian-St. Luke's Medical Center and its network of affiliated institutions. The curriculum is designed for practicing professionals as well as students entering directly from certain baccalaureate level programs. Health managers orient their studies to become skilled in the utilization of system analysis techniques intended to improve the operational components of a health facility, while systems specialists strive to become thoroughly familiar with the dynamics and nature of the health delivery system.

Professional Goals for Graduates

The Rush Health Systems Management Program is designed to give graduates certain specific professional strengths. They should be able to:

- function as general health systems managers with a commitment to continuous learning and the improvement of the health care system;

- synthesize principles and concepts of health delivery, health care management, and systems methodology in planning, implementing, and evaluating health care systems;
- apply problem-solving principles when making improvements in the health care delivery system;
- function independently and interdependently with other members of the health care team;
- relate findings of research to systems management and practice and explore areas for continued research; and
- analyze the health care system and the manager's role in the context of interacting social, economic, and political systems.

Because the faculty recognizes that education does not stop with completion of the requirements for the degree, the program also aims to educate health systems managers who can cope with rapid changes in the patterns of health care and who can guide these changes effectively. Thus, the Rush program is designed to provide graduates with an educational base upon which to build a continuing learning program throughout their professional careers, either under their own initiative or in a formal doctoral-level program.

Curriculum

The Health Systems Management Program is structured around topics in three areas essential to the education of the health systems manager: Health Care Services, Systems Sciences, and Applied Studies.

The Health Care Services areas will focus the student's attention on the various components of the health delivery system, the professional participants and their roles, and current issues impacting the system today. In addition to clinical and administrative participation, the student will review the relevant research and practice of social scientists, legal authorities, economists, and others who have applied their disciplines to problems drawn from the health delivery system.

The Systems Sciences areas will develop the student's ability to structure and solve operational and organizational programs in a quantitative manner. This area will assist the student in recognizing the important parameters of management systems and will insure that, through experience in solving a wide variety of classical problems of various

types, the student will be prepared with fundamental analytical skills to deal with a wide variety of management problems in the health delivery system.

As most professional advanced degree programs demonstrate, the crucial component of the student's experience is guided, supervised application of knowledge in real and simulated professional practice situations. This program will provide such an experience in an Applied Studies component. The Applied Studies will consist of a set of structured systems analysis or management studies, formulated to expose the student to a wide variety of systems problems. The student will be required to define problems where they exist and to utilize analytic and managerial skill in reaching realistic solutions. Where appropriate, students will follow their recommendations through to full implementation and evaluation. Applied Studies will utilize the Rush System and its cooperating network affiliates as a laboratory, and the administrative staff of these institutions as adjunct faculty.

Course Sequence and Requirements

The curriculum is divided into two phases. *Phase I* consists of two core quarters (4 courses). Each student's background will determine the number of core courses to be taken. *Phase II* consists of four quarters that provide an intensive, experience-oriented systems knowledge of the hospital and related facilities. The emphasis of Phase II is on review, analysis, and problem solving of actual ongoing systems.

I. Phase I—Core (Health Care Services, Systems Sciences)

Four core courses (HSMGT 501 and 502, HSMGT 511 and 512) will provide in-depth, intensive orientation to students admitted to the program. They will be offered during the fall and winter academic quarters.

Each quarter will focus simultaneously on Health Care Services topics and certain areas of Systems Sciences, including quantitative analysis, systems analysis, design methodology, etc.

Some students may not require all of the core courses. Each student's academic and experiential background will be evaluated to determine if a student already has acquired the knowledge of any or all of these courses.

This determination is made by the Department Chairman and will be included with the letter of admission. Phase I must be completed prior to entering Phase II. Students entering Phase II directly would need only 58 quarter hours for the M.S. degree.

II. Phase II—Applied Studies

Most of the courses in Phase II consist of both classroom and practical project work and are structured around a variety of areas related to the management and provision of health care services. After the second quarter of Phase II, the students will select an area of concentration which will be the basis for their concentrated study project. Each student's project will be submitted and approved individually and may be a combination of thesis, independent study and/or electives. This project will be equivalent to eleven (11) quarter hours and will be taken in the last quarter of the program. Areas of concentration are:

- 1. Health Law/Public Policy
- 2. Health Economics and Financial Management
- 3. Management of Hospitals and Health Care Facilities
- 4. Industrial Engineering and Operations Research

Health Systems Management Curriculum

First Year Phase I				First Year Phase II	
Fall		Winter		Spring	
HSMGT 501	8	HSMGT 502	8	HSMGT 521	4
HSMGT 511	8	HSMGT 512	8	HSMGT 531	4
				HSMGT 524	4
				HSMGT 541	2
16		16		14	
Second Year Phase II					
HSMGT 522	4	HSMGT 544	5	HSMGT 562	4
HSMGT 532	4	HSMGT 552	4	HSMGT 598	0-11*
HSMGT 551	4	HSMGT 561	4	HSMGT 599	0-11*
HSMGT 542	2	HSMGT 581	2	Electives	0-11*
Total	14	15		15	
Total				90 quarter hours	

*Combination of thesis, independent study, and/or electives in the chosen area of concentration will be approved on an individualized basis.

Gaining Admission

Applications will be considered for enrollment beginning in the fall quarter. Minimally, students should have received a baccalaureate degree from an accredited college or university. Basic courses in financial accounting and statistics must be completed prior to matriculation in the program. In addition, it is strongly recommended that courses in economics (macro and micro) and computer science also be completed. An academic record of scholastic excellence is an important consideration. Applicants with graduate credit in quantitative or administrative fields, seeking to complete their master's degree or obtain a second master's degree,

are strongly encouraged to apply because such preparation may reduce the program length.

In addition to demonstrating the completion of a baccalaureate degree, students are expected to submit the following:

1. A completed application accompanied by the \$25 application fee.
2. A copy of official transcripts of all previous college and university studies.
3. Three letters of recommendation supporting their ability to pursue the program.
4. Scores from the Graduate Record Examination or the Graduate Management Aptitude Test.

Research Activities

A major objective of the Department of Health Systems Management focuses on research activities. This research includes studies in the smallest operational components of the Medical Center as well as computerized hospital-wide information systems, the evaluation and proposal of models for health care delivery, and the needs of the population served by the Rush University System and its affiliated and associated institutions. During the past few years specific research has been conducted in the areas of patient services, nursing services, hospital and university support services, management information systems, and financial systems.

Research on patient services has ranged from an evaluation of outpatient programs in practicing clinics and the Emergency Room to the examination of uses of the inpatient

facilities at Sheridan Road Pavilion and Johnston R. Bowman Health Center for the Elderly. Both nursing staffing and nursing productivity assessments have been conducted, with special emphasis placed on primary nursing care. Research in hospital and university support services has resulted in a unique system of evaluating housekeeping quality and financial and statistical indices for medical colleges. Project studies in management information systems areas have resulted in improved census systems, better attendance and overtime systems, and an evaluation of the implementation of the Spectra 2000 Medical Information System at Sheridan Road Pavilion. Cost pricing analysis and a systems analysis of the Medical Center budget process have been undertaken in financial system research.

Service Activities

Members of the faculty of the Department of Health Systems Management provide service to the Medical Center through the management positions they hold. Hospital administrators, health care planners, academic managers, financial officers, corporate and labor attorneys, and data processing managers function as both practitioners and teachers. The faculty is supported by managers outside the Medical Center who represent hospital and health care consultants, national associations, and network institutions.

Many of the faculty members also provide service to the improvement of the health delivery system through outside committee work. Members of the faculty have represented the institution as well as the department in activities sponsored by the American Hospital Association, the Hospital Financial Management Association, the American College of Hospital Administrators, the Hospital Management Systems Society, and the Illinois Hospital Association.



Section of Clinical Nutrition
Section of Medical Technology

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Section of Clinical Nutrition

Dorice M. Narins, Ph.D., Director
E. Virginia Pinney, M.S., Associate Director

Faculty

Ayers, W.	Farag, W.	Kreuger, C.	Pinney, E.
Castellanos, M.	Hart, J.	Mackey, L.	Roland, D.
Dolecek, T.	Hassel, M.	Narins, D.	Vilas, N.

Educational Activities

The faculty of the section, by participation in teaching a number of courses outside the department and outside the college, provides medical students, nursing students, and graduate students with an understanding of

nutrition. The section also participates in the education of medical students through clerkships. In addition to the nutrition courses given as part of the regular curriculum, the section offers electives that are open to all qualified students.

Research Activities

At the present time, there are three general areas of research: mineral metabolism; aberrations of growth, including obesity and undernutrition; and evaluation of patient education techniques.

The section has several projects studying aspects of zinc metabolism. One project is to determine the zinc status of pregnant alcoholics and its relation to the development of their offspring. A second project is to determine the effect of zinc and/or copper supplementation of the altered taste perception of patients with cancer. A third project is to evaluate the trace mineral status of patients with cancer. It is anticipated that research in

this area will be expanded to include studies of trace mineral status in other disease states.

Funding is being sought for studies of the effects of early feeding patterns on the development of obesity. A study of the effectiveness of various methods of weight control on adolescents is in progress. As more funds become available larger studies on the etiology of obesity and applied studies will be developed.

Research in patient education and evaluation of materials has been important in the past. It is anticipated that while these efforts will continue, they will constitute less of the total as the amount of basic research increases.

Service Activities

Members of the section consult and provide patient services for the Pediatric Genetics

Clinic, Oncology, Adolescent Obesity Clinic, Preventive Medicine, and Medical Intensive Care Unit.

Master of Science Program in Clinical Nutrition

The Clinical Nutrition Program at Rush is a graduate professional program designed to train individuals primarily for careers oriented to patient care and secondarily as preparation for further advanced education. Graduates will be prepared to work with physicians, nurses, and other health professionals in providing total care for the patients in a variety of settings. Career possibilities are varied, including private practice, research and teaching, as well as the more

traditional positions in specialized care facilities, hospitals, departments of public health, and professional organizations. The Clinical Nutrition Program's approach takes students from a wide variety of academic backgrounds and provides a strong foundation in the basic sciences and, through individualized practicum experiences, provides a unique, strong, applied educational experience at Rush-Presbyterian-St. Luke's Medical Center and its network of affiliated institutions.

Philosophy

The program leading to the master of science degree with a major in clinical nutrition is designed to give students a thorough knowledge of clinical nutrition, expertise and confi-

dence in health team interaction, and skills in communication and teaching.

Because the vital relationship between nutrition and health is receiving greater recognition, the role of the clinical nutritionist

has expanded. New expertise, the ability to assume more significant responsibility as a member of the health care team, and the ability to contribute to the education of practicing and future health professionals is required.

The clinical nutritionist works with physicians, nurses, nurse practitioners, social workers, and other health care providers, all sharing a primary concern—the patient.

Effective interaction and communication between these professionals are dependent upon a broad base of common knowledge. Because Rush University has organized its academic programs on the belief that cooperative activities focused on the patient are enhanced by interdisciplinary education, students in the clinical nutrition program take courses with graduate nursing students and with medical students.

Objectives

It is anticipated that, upon completion of the master of science program in clinical nutrition, the graduate will be able to:

- obtain nutritional history information and correlate it with physical, anthropometric, clinical, and behavioral data to evaluate the dietary and nutrient status of the patient;
- advise and recommend to the physician or primary health care provider a feasible nutritional management program for the patient;
- function as a consultant to the entire health care team—physicians, nurses, physical therapists, social workers, and health students—regarding the nutritional care of the patient;
- function as a nutrition educator and coordinator of education in nutrition for practicing health professionals, as well as students of health professions;
- function as an effective educator in nutrition for patients, their families, and community members; and
- function as a resource for nutrition information and guidance needed by the health care team, in the hospital, and in the community.

Prerequisites

Applicants to the graduate program in clinical nutrition should have completed a baccalaureate degree from an accredited college in one of the fields of foods and nutrition, dietetics, biochemistry, biology, or nursing. Specific course offerings and requirements may vary from campus to campus due to differences in curricular design, scheduling, and course content. Because baccalaureate programs vary somewhat, each will be reviewed to ensure the student has the background necessary for the master's program. The following listing suggests the kinds of courses which are normally required before the student comes to the Rush campus:

Courses	Quarter Hours	Semester Hours
Chemistry, Inorganic, Organic, and/or Biochemistry	16-18	12
Human Anatomy and Physiology	10-12	6-8
Microbiology	5-6	3
Statistics, Introductory	4	3
Human Nutrition	10-12	8
Nutrition in Disease and/or Diet Therapy	5-6	3-4
Behavioral Sciences	16-18	12
Economics	5-6	4
Total	71-86	51-54

Evidence of registration as a dietitian is preferred but not required.

Eligibility

All factors are taken into consideration when evaluating each student's application. Students are not necessarily excluded or accepted into the program because of deficiencies or proficiencies in any one area. An applicant not meeting regular admissions requirements may, at the discretion of the Graduate Admissions Committee, be offered enrollment as a special student as defined below.

The graduate program recognizes three categories of students:

1. Regular students, who have been accepted for admission to the master's degree program;
2. Special students, who have not been accepted to the degree program but have permission to enroll in specific courses for academic credit (there is a limit of two courses in this category);
3. Auditors, who have obtained permission to attend a course but are not seeking academic credit (no academic grade is reported).

Method of Application

An application and recommendation forms for the clinical nutrition program may be obtained by writing:

Director of Admissions
The College of Health Sciences
Rush University
600 South Paulina
Chicago, Illinois 60612
(312) 942-7100

Applicants to the graduate programs in clinical nutrition should make certain that the following material is on file at the College of Health Sciences at least four weeks prior to the beginning of the term of expected matriculation:

1. completed application;
2. \$25 application fee;
3. three letters of recommendation;
4. results of the Graduate Record Examination (G.R.E.)

Curriculum

Fall		Winter		Spring		Summer	
BIOCH 461	3	BIOCH 462	3	BIOCH 463	3	NUTRI 553	4
NUTRI 523 or		NUTRI 566	1	NUTRI 567	1	NUTRI 591 or	
NUTRI 524	3-4	HLCED 583	2	HLCED 584	2	NUTRI 599	4
NUTRI 565	1	PHYSO 512	5	PPHYS 576	2	NUTRI 561	2
PHYSO 511	5	NUTRI 501	2	NUTRI 561	2		
		NUTRI 551	1	NUTRI 552	3		
12-13			14	13		10	
Total required courses							49-50*
Electives							6
Minimum for graduation							55-56*

*Non-RDs must take NUTRI 524 instead of NUTRI 523 and will, therefore, accumulate one more credit hour. Electives must include at least two credits in HCSYS, HLCED, HLSOC, or HSMGT course work. Most students take any elective each term.



Section of Medical Technology

Marjorie Stumpe, M.A., Director
Herb Miller, M.H.S., Assistant Program Director
John P. Ayer, M.D., Medical Director

Faculty

Carr, M.	Kachmar, J.	Miller, H.	Stumpe, M.
Chung-Bin, A.	Kaplan, R.	Siegel, J.	Tarr, M.
Gewurz, A.	Lee, N.		

Educational Activities

Bachelor of Science Program in Medical Technology

At the College of Health Sciences, the program leading to the bachelor of science degree with a major in medical technology requires successful completion of the pre-health curriculum and the upper division study at Rush University campus.

Students interested in the undergraduate medical technology program are encouraged to submit applications to the affiliated colleges of their choice (see pp. 131) soon after the beginning of their senior year in high school. A college preparatory program in high school that includes chemistry, biology, physics, and mathematics is the best preparation for enrollment in any of the affiliated colleges.

Each college has its own entrance requirements. A student enrolled at an affiliated college for the Rush program will file appropriate forms with the College of Health Sciences to formalize participation in the program. The student's academic progress will be monitored by both Rush and the health careers advisor of the affiliated college. All candidates for admission must provide evidence of good physical and mental health. Students meeting the objectives of the pre-health curriculum and obtaining the approval of both the health careers advisor and the dean of the College of Health Sciences will move to the Rush University campus to pursue the final two years of the program.

Due to limited enrollment, students already enrolled in one of the affiliated colleges in another program and students desiring to transfer to an affiliated college for the Rush program must be approved by the health careers advisor and the admissions office at Rush.

Applications may be obtained by writing to the Director of Admissions of any of the affiliated colleges.

Transfer Applicants. The College of Health Sciences also considers a limited number of

transfer applicants at the third year level in addition to students who complete the pre-health curriculum at an affiliated college. Selection is competitive, and only the most qualified applicants will be accepted. Only those spaces not filled by Rush students from affiliated colleges will be available for transfer students. Many transfer applicants have been college graduates as well as students who have attended non-affiliated colleges.

All applicants must have satisfactorily completed the pre-health curriculum at an accredited college or university. Rush University does not offer the pre-health curriculum on its campus. No transfer credit is awarded for required course work in which the student earned less than a "C" grade or its equivalent. Required courses should be taken for a grade rather than a pass-fail option.

Transfer applicants apply directly to the College of Health Sciences. It is advisable to apply early in the academic year preceding the intended year of matriculation. Guidance in course selection is available through the Admissions Office at Rush.

Applications for transfer students may be obtained from:

Director of Admissions
College of Health Sciences
Rush University
600 South Paulina
Chicago, Illinois 60612
(312) 942-7100

The application should be accompanied by a \$25 non-refundable application fee, high school transcript (including test scores), all college and university transcripts, and three recommendations. A personal interview is also required as part of the application process.

When the application is complete, all items are reviewed and evaluated. If required course work is still in progress, an offer of acceptance is contingent upon satisfactory completion.

Philosophy

The contribution of medical technology to the patient and to the health care delivery system is primarily one of diagnostic services. As clinical medicine expands in the variety and number of diagnostic tests performed, and as new methodologies and instruments become increasingly sophisticated, there is a crucial need for more high-quality professionals—not merely more technologists. Today's professional technologists must not only develop technical expertise, but teaching and administrative competence as well. They must be able to adapt to rapid changes in the field while maintaining an optimal level of performance. As members of the health care

team, medical technologists must have a basic understanding of the role of other health practitioners in order to function effectively and bring the best possible care to the individual and the community. Although the work in medical technology often does not place the practitioner in actual physical proximity to the patient, the technologist, nevertheless, must maintain a high degree of compassion and empathy and a constant awareness that the welfare of the patient is the ultimate goal.

It is the aim of the Rush University baccalaureate program in medical technology to educate technologists to meet the changing needs of laboratory medicine more effectively and with greater efficiency.

Objectives

The objectives of the program in medical technology are to provide educational experiences which will enable the student to:

- acquire knowledge and proficiency in the technical skills required in the medical technology profession;
 - develop problem-solving abilities in the application of scientific theory to the clinical practice of medical technology;
 - acquire the basic principles of management to assist in the supervision of medical technologists and other supportive level laboratory personnel;
 - appreciate the importance of continuing education as an avenue of professional growth;
 - acquire an understanding of the roles of other members of the health care team and an ability to function cooperatively within the team;
 - appreciate and practice professional ethics in providing quality health care to the patient and to the community.
-

Pre-Health Curriculum

The pre-health portion of the medical technology program is taken at an affiliated college and requires two or three years of study, depending upon the college. These years are devoted to preparing the scientific foundation upon which the practice of medical technology can be built. The first year emphasizes courses in biological, physical, and behavioral sciences, with options in the humanities. The succeeding pre-health years are used to increase depth in the sciences as they relate more specifically to health fields

and to enhance personal experience by a broad choice of electives in the humanities.

Each affiliated college has a unique participation with Rush. Specific course offerings and requirements may vary from campus to campus due to curriculum offerings, scheduling, and course content. Each pre-health curriculum is different, but all provide the background necessary for the professional component of the program in the final two years. The following listing suggests the kinds of courses that normally are required before a student comes to the Rush campus.

Pre-Health Curriculum

Courses	Quarter Hours	Semester Hours
Chemistry, Inorganic	10-12	8
Quantitative Analysis	5-6	4
Chemistry, Organic	5-6	4
Human Anatomy and Physiology	10-12	8
Microbiology	5-6	4
Statistics, Introductory	4	3
Behavioral Sciences (Psychology, Sociology, or Anthropology)	18	12
Academic Electives	33-26	17
Total	90	60

Upper Division Studies

Following the pre-health curriculum, upper division studies are devoted to completing the professional segment of the program leading to the bachelor of science degree with a major in medical technology.

The comprehensive technical curriculum at Rush University prepares the student to enter the practice of medical technology. Each graduate is eligible to take the National Certifying Examination given by the American Society of Clinical Pathologists, and upon passing the examination becomes certified as a Medical Technologist, MT(ASCP). The program is accredited by the American Medical Association's Council on Medical Education.

In the junior and senior years the student integrates the theory of clinical medicine with the practice of clinical laboratory procedures, learning basic theory and skills in hematology, clinical chemistry, immunology, and clinical microbiology in the junior year; going on to more advanced courses in those areas in the senior year. Senior students apply basic concepts as they rotate through the laboratories of Presbyterian-St. Luke's Hospital and other affiliated institutions. In addition, students are prepared to fill supervisory and teaching positions through courses in management.

Baccalaureate Medical Technology Curriculum**Third Year**

Fall		Winter		Spring	
MEDTK 301	4	MEDTK 302	1	MED 301	5
MED 401	4	MICRO 311	5	BIOCH 402	5
BIOCH 301	4	BIOCH 401	4	MICRO 411	5
IMMUN 301	4	IMMUN 403	3		
		IMMUN 421	3		
16		16		15	

Fourth Year

Fall		Winter		Spring	
MED 425	2	MED 426	2	MEDTK 424	8
BIOCH 403	2	MEDTK 422	8	MEDPH 321	4
MEDTK 421	8	BIOCH 404	2	MEDTK 441	2
MEDTK 423	4	MEDTK 425	4	HCADM 301	3
16		16		17	
Subtotal					96
Pre-Health Curriculum					90
Total					186

*Courses may not be always offered in sequence listed.

*All courses are required courses.

Service Activities

The majority of our faculty are actively involved in the clinical laboratories of Rush-Presbyterian-St. Luke's Medical Center, maintaining either an active research or clinical position in their area of specialty. Several of our faculty hold joint appoint-

ments in Rush Medical College. Our program faculty and resources span the gamut of clinical laboratory medicine and, therefore, we actively support and participate in all areas where technical laboratory application is involved.





Department of Religion and Health

Christian A. Hovde, Ph.D., D.D., The Bishop Anderson Chairperson
Bernard Pennington, M. Div., Director, Clinical Pastoral Services

Faculty

Hovde, C. Pennington, R.	Ulrich, L. Fitchett, G.	Katonah, J. Taylor, J.	Wagner, W.
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Research Activities

The research efforts of the department are in their infancy. Until recently, the department had been functioning as a service and training department and had not been actively engaged in research. Research is now being incorporated into the training of clinical pastoral education (CPE) theological stu-

dents. Areas now being investigated include: attitudinal changes to life crises following educational process; faith systems and their effect on mobilization of physical resources; religious symbolism and patient/family support systems; and acute grief behavior.

Educational Activities

The Department of Religion and Health is responsible for providing pastoral care to patients, their families or supporting persons, and the staff personnel who serve them within Rush-Presbyterian-St. Luke's Medical Center. Additionally, the department provides an accredited program in clinical pastoral education for pastoral personnel, in humanistic and theological studies within the colleges, and in research in the area of religion and health.

Accredited by the Association for Clinical Pastoral Education, the department offers basic, advanced, and supervisory education in pastoral care. This program is oriented to graduate theological students, pastors, members of religious orders, or other health personnel who are interested and involved in pastoral care and counseling in the midst of a health crisis. Under faculty supervision, students carry direct responsibilities for ministry within patient care areas on an ecumenical basis which includes a sensitivity to particular parochial practices. Students use clinical pastoral education in preparation for parish ministry, chaplaincy, teaching, pastoral counseling, or CPE supervision.

Basic Clinical Pastoral Education. An intensive 11-week introduction to pastoral care, basic CPE focuses on models of ministry and their effect in patient care. Viewing the patient as a partner in learning, students engage in theological reflection and use pastoral resources with patients and health personnel; they work toward better understanding of the interface between theology and behavioral sciences in understanding the human condition.

Advanced Clinical Pastoral Education. Advanced CPE is a year-long residency program for persons who have already completed their basic theological degree, have had pastoral experience, and want a pastoral care specialization, such as certification as a chaplain through the College of Chaplains, American Protestant Hospital Association. Students function as pastoral members of interdisciplinary health teams to develop the capacity to utilize their pastoral perspectives and competence through a variety of pastoral encounters.

Supervisory Clinical Pastoral Education. Supervisory CPE is designed for qualified persons who have demonstrated pastoral professional competence, and who want to specialize in supervision in preparation for certification with the Association of Clinical Pastoral Education. Students are helped to develop both a theory and theology of pastoral practice, a philosophy of CPE that includes understanding appropriate educational models' theory and practice, and a versatility in using supervisory skills and methods.

The program of religion and health is currently being developed to enlarge upon existing course offerings for interdisciplinary and clinical experiences within the various colleges of the university. The Bishop Anderson Professorship has been established for teaching in religion and health. The primary concentration of teaching in this program has been in thanatology, ethics, and in the philosophy of medicine.

Service Activities

The department provides round-the-clock religious ministry to patients in the hospital, providing sacraments, church services, individual counseling, and grief ministry to any

person who is in need of them. It is available to support members of the student body and staff and to respond to emergencies when needed.

Courses Offered

A. Clinical Pastoral Education

Course Title: The Art of Healing: A Theological Perspective and Pastoral Practice

Description: An 11 week (one quarter), intensive clinical course focusing on the interpersonal dimensions of the healing process; an appreciation of the patient as a total being; an exploration of the anxieties and inhibitions generated in relating to the sick; specialized communication skills, seeing the patient as a partner in the healing task; assisting the student to discover and use his or her uniqueness in relating therapeutically to the sick.

Note: Students may be accepted for this course from any discipline or field of study. The descriptions of seminars that follow are built upon the experience of teaching the course for theological students. However, no difficulty is inherent in incorporating non-theological students into the course.

Note: The course may be repeated. Each repetition is at a progressively more sophisticated level.

Prerequisites: For theological students: at least one year of graduate theological education and an interview with one of the faculty of the Department of Religion and Health.

For non-theological students: an interview with one of the faculty of the Department of Religion and Health.

Seminar: Clinical Case Conference

Faculty: Supervisory/Visiting Staff

Time: Two times per week at 90 minutes each
Clinical seminar using verbatim written materials or tape recordings of actual patient visits by students. One student presents material each seminar period; all students present in a sequence that they construct. Verbatim materials are circulated to seminar members in advance of the seminar to allow careful preliminary study.

The supervisor and the seminar members engage the presenting student in an examination of the ministry. Together they explore the student's understanding of the patient's communication, the student's assessment of the patient's pastoral needs, the student's attempt to carry out an appropriate ministry, the student's ability to use his own faith meaningfully in the ministry, and the meaning of the student's subjective response to patients.

Seminar: Sermon Preparation and Delivery

Faculty: Supervisor

Time: One time per week at 90 minutes

Students prepare a sermon manuscript and give the sermon in the hospital chapel with their seminar group as the audience. Seminar then relocates and the preaching experience is examined in terms of its appropriateness to the hospital congregation, its articulation of the faith, its witness to the faith and development of the student, and its effectiveness as interpersonal communication. Usually these sermons are amended and given during a Sunday worship service in the hospital chapel.

Seminar: Personal and Professional Concerns

Faculty: Supervisor

Time: Two times per week at 90 minutes each

This seminar gives students the opportunity to report spontaneously on critical events and issues in their hospital ministry; to examine issues of personal or professional identity; to examine problems in communicating or functioning within the seminar group; to explore the meaning and context of their ministry, their relations with other medical center disciplines, and their ability to think theologically about their experience; to examine individual problems of functioning effectively in the pastoral role; and to assist students in evaluating their progress in training.

Seminar: Didactic Presentations
Faculty: Supervisor and Invited Staff
Time: One time per week at 90 to 120 minutes

Presentations are made by professionals in other disciplines, by supervisory staff, and by students themselves in an attempt to bring theoretical material to bear on the practical work of ministry and to assist the student in clarifying operational concepts.

From time to time the didactic presentations are more structured to cover various important topics. Some subjects that have been presented in the past or which will be covered in coming quarters include

Suffering: Its Importance for Health. This seminar explores the various philosophical and theological responses to suffering and their expression among hospital patients. The implications of the different responses to suffering for healing are explored.

Aging, Faith, and Health. A brief survey of the important biological, psychological, and social changes that accompany aging sets the background for an exploration of the role of faith in the life of older persons, and particularly in their adjusting to and coping with illness.

Faith as a Factor in Health. A brief survey of the major theories of disease and health, scientific and unscientific, Western and non-Western, forms the background for a review of the literature on the role of faith, trust, and hope in recovery from illness. Case examples from students' experiences are reviewed.

Individual Supervision

Faculty: Supervisor
Time: 1 to 2 hours per week

Supervisor and student together develop an individualized contract for learning. The students are enlisted as partners in the learning process by helping them identify their goals, plan for their learning, and evaluate their progress. Written records of pastoral work are examined in detail as well as written and oral attempts of the students to understand and incorporate the values from the total program experience and to synthesize the clinical, theological, and theoretical data encoun-

tered. Supervision of the students on the floor while seeing patients is also provided.

Course Title:

The Art of Living
Guided Study or Research

Faculty: Supervisor
Time: Hours to be determined

Each student is expected to undertake a reading or research program which is complementary to learning goals and/or remedial in terms of gaps in basic preparation for understanding pastoral care. Supervisor is consultant to the student for the study program. Note: Expected of year-long students only.

Clinical Practice

Faculty: Supervisor and Staff
Time: 20 to 30 Hours per week

(A) Each student has a designated area of pastoral responsibility, usually 40 to 50 beds. Student is assisted to develop working relationships with the treatment team and to develop a style of coverage appropriate to the area.

(B) Each student serves once per week as on-call chaplain for overnight or weekend coverage and/or spends an evening visiting with preoperative patients. These special duties involve the student in ministry in situations of crisis or heightened anxiety.

(C) Clinical practice requires special arrangements for non-theological students.

Comprehensive Evaluations

Faculty: Supervisor

Students prepare written evaluations of themselves and of the total program experience. These evaluations are shared with the supervisor and fellow students and examined with each student in seminar and individually. The evaluation periods help students examine their investments in learning, goals, use of program resources, relationships, and progress toward learning goals. The supervisor prepares a detailed written evaluation of each student at the end of the program; this is usually shared with the student. The comprehensive evaluations are necessary for determining satisfactory completion of the course and giving credit where appropriate.

The course may not be taken more than twice for academic or field work credit.

Students are encouraged to participate in the teaching programs of the hospital pertinent to their clinical field, within the limitations of their primary educational programs and clinical responsibilities.

B. Courses Offered to University students in general

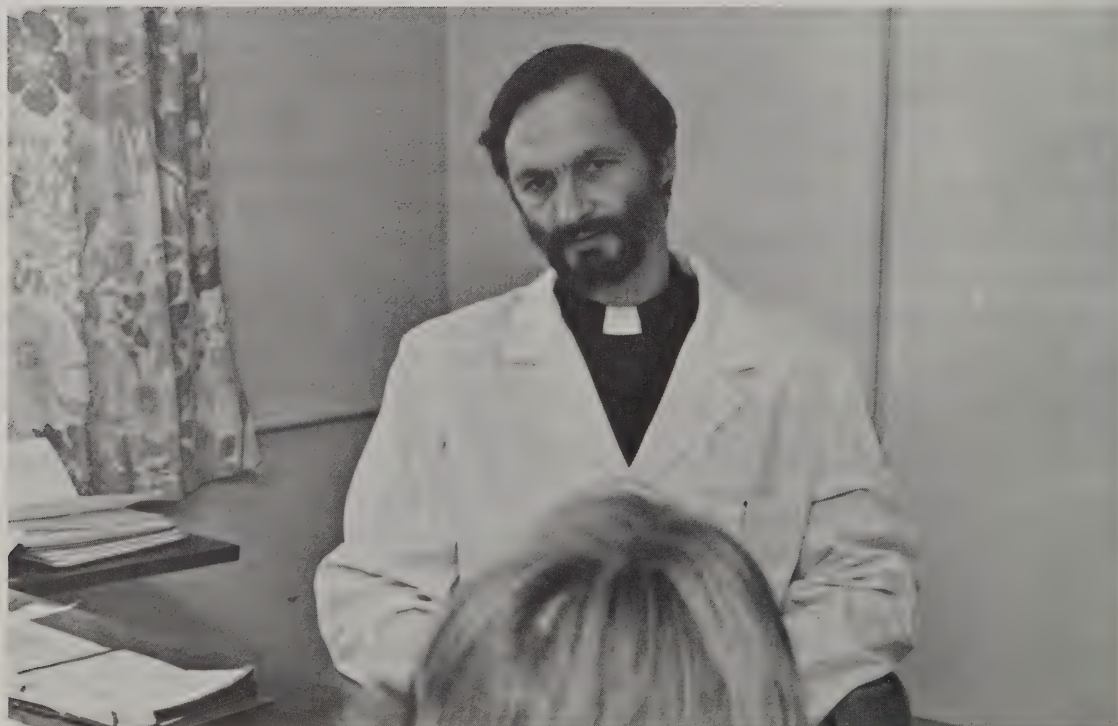
BEHAV 461: Death and Dying

Social, cultural, emotional, and religious factors involved in the grief process surrounding death. Investigation of the environment in which death occurs and its effect on the quality of life possible. Offered each quarter *except* summer. Seminar form; permission of faculty required.

BEHAV 462: Death and Dying

Builds on #461, which is a prerequisite. Uses the clinical experience of the students to address questions of support of individual patients and their families, personal reactions of medical personnel to patient death, and their own concepts of death. Offered each quarter *except* summer. Seminar form; permission of faculty required.

On occasion, individual study projects may be arranged for credit for students who wish to pursue a specific portion of this material in greater detail.



Academic Policies

Credit <i>Credit Hours.</i> The quarter hour is the unit used by the College of Health Sciences for determining credit for courses taken at Rush University. One quarter hour generally represents a lecture or seminar meeting one hour each week, or a laboratory or clinical experience of two or three hours per week (sometimes more) for the ten weeks of the quarter.	An examination for each course generally is given during the 11th week. Full-time students will carry a course load of 12 to 17 hours each quarter. Outstanding students may petition the dean to register for additional courses. Written approval is required. Degree candidates must also obtain permission for less than full-time course work.
Part-Time Study Undergraduate students must plan on full-time course work. Graduate students may enroll for courses on a part-time basis. However, all prerequisites for a specific course must be met before admission to the course. Part-time graduate students must complete degree requirements	within 36 months. The program director has the discretion to make special arrangements in the above cases. Graduate students enrolling on a part-time basis may be able to switch to full-time enrollment depending upon availability of courses and approval of their program director.
Absences Students are fully responsible for all material presented in class sessions. Students are expected to attend all seminar and clinical practice periods, and are fully responsible for all content presented therein. When illness or other special circumstances prevent	attendance, the student must inform the instructor in advance, when possible, in order to plan for meeting objectives on an individual basis. Students absent from a final examination will receive a zero for that examination or an incomplete for the course as determined by the course director.
Examinations The examination policy is the responsibility of the individual course director, who will inform students of examination requirements	for that particular course. A period at the end of the quarter is provided for final examinations. This period may be used as the course director chooses.
Transfer of Credit Undergraduate courses taken at an accredited college or university that fulfill the pre-health curriculum requirements may be applied toward the baccalaureate degree in medical technology at Rush. Elective credit may be fulfilled by upper division courses taken at another institution. Graduate level courses taken at a recognized college or university may be applied to	the master of science degree at Rush, subject to the approval of the program director. Credit in excess of nine quarter hours requires approval of the dean. Concurrent enrollment at another institution must be approved by the dean. A Transfer Credit Approval form, available in the Office of the Registrar, must be submitted to the dean within 30 days prior to commencement of the concurrent study.
Registration Registration for a new term is normally completed in an announced pre-registration period during the preceding term. Students must be registered and in attendance no later than Monday of the second week of each quarter or they will be dropped from the class roster. Registration, dropping and adding	courses, and withdrawal from school must be done by completing forms provided by the Office of the Registrar. Registration is complete only after tuition and fees have been paid in full or deferred payment contracts have been signed with the Office of Financial Affairs. Students may attend classes only after they have com-

pleted registration. Students registered in a course but failing to participate will receive "F" grades.

Identification Cards. Each student receives an identification card at matriculation. Each term the card is validated at the completion of registration. A valid card is needed for identification within the Medical Center complex, for use of the library, and for admission to some events.

Adding or Dropping a Course

After the registration form has been accepted by the Office of the Registrar, students may add or drop courses by completing a form provided by that office. The student's advisor must sign these forms before they will be accepted. Monday of the second week of the quarter is the last day to add a course.

The official date of withdrawal from a course is determined by the date the completed form is returned to the Office of the

Independent Study. With written permission from the program director, a student may pursue an independent reading or independent clinical study. A preceptor works with the student in designing, monitoring, and assessing the course work. A student interested in this option must fill out an Independent Study Contract six weeks before the quarter the course is taken. Contracts are available in the Office of the Registrar.

Registrar. If a student withdraws by the end of the first week of classes, the course will not appear on the academic record. A "W" grade will appear on the record if the withdrawal occurs between the beginning of second week and midterm. After midterm a "WP" or "WF" grade will be recorded depending on whether the course director considered the student to be doing passing or failing work at the time of withdrawal.

Leave of Absence

A health science student who must interrupt his or her studies for reasons such as sustained ill health or compelling personal situations may apply for a leave of absence for a stated period of time, usually not to exceed one year. Leave of absence requests must be submitted in writing to the Student Evalua-

tion and Promotion Committee and the program director. If approved by them and by the dean, the student must satisfy the conditions of the leave before reentering and must comply with all policies, requirements, and course sequence in effect at the time of reentry. The student will pay tuition and fees at the rates in effect at the time of reenrollment.

Withdrawal from School

Students planning to withdraw from school voluntarily must complete a form available in the Office of the Registrar. The student will obtain appropriate signatures while returning

all Medical Center materials, the identification card, and name pin. Withdrawal is final once all Medical Center bills have been paid and the completed form submitted to the Office of the Registrar.

Grades

Transcripts and Grade Reports. Grades are recorded on the student's permanent academic record in the Office of the Registrar. A transcript of the academic record becomes official only when signed by the registrar and bearing the corporate seal of Rush-Presbyterian-St. Luke's Medical Center.

Official transcripts are released only by written request. Forms for this purpose are available in the Office of the Registrar for on-campus students. There is no fee for this service.

Transcripts will not be released until the student has paid all bills due the Medical Center.

Quarterly grade report forms are sent to the student's local address as soon as grades are recorded each term. This is a student copy only and it should not be accepted by any institution or agency in lieu of an official transcript.

Grade Point Average. Each student maintains a grade point average for all work completed at Rush using the grading system described below. The grade point average is determined by dividing the number of points

received by the number of credit hours attempted in which A, B, C, D, or F grades were received. This computed grade point average is not affected by courses taken on P/N basis or by courses transferred from another institution. These courses are added to the credit hour total only.

Grading System. The following grades are used to report the quality of work at Rush:

Grade	Quality	Grade Points
A	Excellent	4
B	Good	3
C	Satisfactory for undergraduate but below the level expected of a graduate student	2
D	Minimal passing	1
F	Failure	0
P	Passing	—
N	Not passing	—
I	Incomplete work	—
W	Withdrawal prior to midterm of the quarter	—
WP	Withdrawal after midterm—quality of work was passing at the time of withdrawal	—
WF	Withdrawal after midterm—quality of work was failing at the time of withdrawal	—

Undergraduate Student Grades. A grade of “P” or “N” is given for elective courses at the discretion of the instructor and in some cases when the student petitions, not later than the first week, to take the course on a P/N basis with the instructor’s permission.

The grade of “I” is normally given only when circumstances beyond the control of the student prevent completion of course requirements. Students receiving a grade

of “I” are responsible for finding out from the instructor the exact work required to remove the incomplete. In the case of a required course, work shall ordinarily be completed and a letter grade received by the end of the fifth week of the next quarter the student is enrolled or sooner at the discretion of the instructor and course director. An “I” grade not removed by midterm will revert to a final grade as determined by the course director. A grade of incomplete in an elective course will automatically revert to an F or N grade unless a change of grade is received by the registrar within one calendar year.

Dean’s List. Undergraduate students earning a 3.5 or higher grade point average for at least 12 credits for a quarter are given recognition by having their names placed on the Dean’s List.

Graduate Student Grades. Graduate students must earn a 3.0 cumulative grade point average to graduate and may repeat a course in which a C, D, or F has been assigned. These courses may be repeated only once but the grade for the repeated course replaces the first grade in the cumulative grade point average.

Graduate students may request an incomplete from the course director. An I grade not removed by the end of the next quarter will revert to a final grade as determined by the course director.

Elective courses taken in other colleges of the university may be taken for a pass or fail grade. If a student wishes to obtain a letter grade for one of these courses the student must negotiate with the instructor within the first week of the course.

Academic Progression

The faculty reserves the right to request the withdrawal of any student whose conduct, health, or performance demonstrates lack of fitness for continuance in a health profession. Any such student not voluntarily withdrawing will be dismissed from the university.

Undergraduate Progression. High academic performance in required courses is expected. Undergraduate students will be

considered in good standing at Rush University unless placed on academic probation.

Academic Probation is assigned to any student who receives a quarterly grade point average below 2.0 or whose cumulative grade point average falls below 2.0. Students placed on probation have two quarters in which to regain the status of good standing. Failure to do so will result in dismissal from the university. Medical technology students may

receive no more than one D in the following courses each year to remain in the program:

BIOCH 401, 421

IMMUN 301, 402, 421

MICRO 311, 411

MED 301, 401, 425, 435

MEDTK 301

An F grade in any of these courses will result in dismissal.

No D grade in a practicum course of the program is acceptable for graduation. A D grade in such a course may be repeated only once.

Graduate Progression. Only grades of A, B, or C may fulfill degree requirements in all required courses as listed in curriculum out-

line. A clinical nutrition student who earns a C grade in NUTRI 551, 552, or 553 must make special arrangements with the program director to repeat that work. Less than a C grade in those courses will result in dismissal from the program.

Students must earn a cumulative grade point average of 3.0 in order to graduate. A student whose cumulative grade point average falls below a 3.0 may enroll for one quarter as a probationary student to attempt to raise his or her cumulative grade point average. Further enrollment will be denied if the grade point average is not raised to a 3.00 in that quarter.

Reenrollment

Any student who has withdrawn from a program and has not been enrolled for two consecutive quarters or any dismissed student may apply for readmission by submitting an application for this purpose with a fee of \$25.00 to the Office of Admissions. Applications for reenrollment must be received at

least one quarter before the planned return. Reentering students must meet the conditions for reenrollment stated in their dismissal or reentry acceptance letter, and all policies, requirements, and course sequence in effect at the time of reentry. The student will pay tuition and fees at the rates in effect at the time of the reenrollment.

Requirements for Graduation

Bachelor of Science. The bachelor of science degree, with a major in medical technology, requires a minimum of 180 quarter hours. This includes at least 90 quarter hours earned as a lower division student at an affiliated school or before entrance as a transfer student.

Candidates for the bachelor of science degree must earn a 2.0 cumulative grade point average in all computed upper division credits taken at Rush University.

Participation in cap and gown at commencement exercises is expected of all graduates.

After receiving the baccalaureate degree, graduates are eligible to take the National Certifying Examination given by the Board of Registry of the American Society of Clinical Pathologists.

Graduation Honors. Candidates for the bachelor of science degree who have demon-

strated academic excellence are honored at commencement exercises by the Rush University faculty each spring. Those earning a 3.4 or better grade point average based on six quarters at Rush are awarded the bachelor of science *cum laude*; those with 3.6 or better, *magna cum laude*; those with 3.8 or better, *summa cum laude*. This is based on six quarters of work at Rush and does not include any work done at other institutions.

Master of Science. The master of science degree requires a minimum of 54 quarter hours. A cumulative grade point average of 3.0 is required. All requirements for the degree must be completed within 36 months.

Candidates for the master of science degree are urged to participate in the commencement exercises in June, though many will complete degree requirements during the following August.

Student Records

The Family Educational Rights and Privacy Act of 1974 protects the privacy of current and former students enrolled in most educational institutions.

Students currently enrolled at Rush University will be notified annually of the educational records policy of the university and of their rights under the act and under the federal regulations promulgated pursuant to the act.

Rush University has five official student records for health science students. A student or former student may inspect and review these records after making an appointment with the appropriate office. The records and their locations are as follows:

1. Official Academic Record (transcript)—Office of the Registrar, 1 Schweppe-Sprague.
2. Registrar's Folder—Contains admission application, transcripts from other schools, registration information—Office of Registrar, 1 Schweppe-Sprague.
3. Dean's Folder—Contains written evaluation of clinical work, curricular flow charts, grade report copies—Offices of the Program Directors, Clinical Nutrition and Medical Technology, 4 Schweppe-Sprague—Religion and Health, 7 Schweppe-Sprague—Health Systems Management and the Graduate School, Office of the Dean, 4 Academic Facility.
4. Financial Affairs Folder—Records showing all billing and payments, notes and correspondence dealing with a student's finance—Office of Student Financial Affairs, 1 Schweppe-Sprague.
5. Financial Aid Folder—All information concerning financial aid for the student—Office of Financial Aid, 1 Schweppe-Sprague.

Students may request a copy of any portion of their records from the holder of that file. The request must be in writing, signed, and specifically identify the record desired and include the student's major, year, and social security number. There is no charge for copies of the student transcript. Other reproductions cost 50¢ per page. The university honors requests as long as there is no outstanding obligation to the Medical Center. Students within commuting distance may be asked to review the desired data in person.

Students may request that the university amend information in their records that they believe to be inaccurate, misleading, or that violates their privacy. If the university refuses to amend the records as the student wishes, he/she may request a hearing in order to challenge that decision. A hearing will be granted. Students may place in their educational records statements commenting upon information in the records and/or stating their grievances with a decision not to amend the record.

Those administrators who maintain the records adhere to a policy of limited access for administrators and faculty having a need for information in order for their offices to function, to determine academic progress, or to designate award recipients.

Any disclosure of a student's record to others not listed in these policies requires prior written consent of the student. Requests for information and letters of consent of the student are kept with the records.

A student may waive any of his/her rights under the act and its regulations.

A student may file a written complaint with the Family Educational Rights and Privacy Act Office regarding alleged violations of the General Education Provisions Act and its regulations.

Copies of the act and these written policies and procedures may be obtained from the Office of the Registrar, 101 Schweppe-Sprague.

Directory Information

Certain information is classified by Rush University as directory information: student's full name, local address and phone number, date and place of birth, home town, major field of study, year in school or class, participation in officially recognized activities, dates of attendance, degrees and awards received, previous educational institutions attended by the student and previous majors, and degrees and years earned.

Each fall quarter the Rush Student Address Book is published for student, faculty, and staff use. It contains the student's

name, local address and phone number, major, and class.

At the time of commencement exercises this information is released in public announcements: student's full name, degree and major, previous institution and degree(s) and year(s) earned, and home town.

Students may restrict the release of any item of information that is considered as directory information on a form provided in the Office of the Registrar, 1 Schweppe-Sprague, on or before October 15 each year or the end of the second week of the quarter following matriculation.

Human Investigation

Any project or study involving human subjects must have approval of the Medical Center Committee on Human Investigation. Studies in the community as well as within

the Medical Center must have this approval. The Office of Research Affairs handles all requests and has established the protocol for proper investigative procedures.

Financial Affairs

Expenses

Expenses listed in this section apply to third and fourth year students in the undergraduate program and all students in graduate programs. Expenses for the first years of undergraduate study will depend upon tuition, fees, room, board, and other expenses at the affiliated college attended.

All expenses listed in this section are current estimates of cost levels as of the beginning of fall term 1978. The actual charge of tuition and fees is subject to change without notice, and other budgetary costs used in the determination of financial aid eligibility may also vary somewhat. Institutions utilizing federal aid funds, including Rush, derive living expense levels based upon Bureau of Labor Statistics at the moderate level. Students receiving financial aid must conform their living expenses to these allowable budgets.

Undergraduate: The estimated expenses of a full-time single undergraduate student in the College of Health Sciences are as follows:

	per quarter	per academic year of three quarters
Tuition	\$1,050.00	\$3,150.00
Activity Fee (Fall quarter only)	10.00	10.00
Insurance	40.00	120.00
Books and Supplies	116.00	350.00
Housing and Food (estimated campus housing expense)*	540.00	1,620.00
Transportation	67.00	200.00
Personal	200.00	600.00
	\$2,023.00	\$6,050.00

*Students not living in campus housing will likely have higher costs.

Description of Expense Categories

Undergraduate Tuition: Full-time students taking from 12 to 17 credits are assessed \$1,050.00 per quarter. Part-time students taking from 1 to 11 credits are assessed \$110 per credit. While enrolled as either part or full

time, single coverage under ANCHOR is provided at no additional charge.

Students who are married or who have dependent children will, of course, incur greater living expenses.

Graduate: The estimated living expenses of a full-time single graduate student in the College of Health Sciences are as follows:

	per quarter	per academic year of four quarters
Tuition	\$1,250.00	\$ 5,000.00
Activity Fee (Fall quarter only)	10.00	10.00
Insurance	40.00	160.00
Books and Supplies	125.00	500.00
Housing and Utilities	700.00	2,800.00
Food	250.00	1,000.00
Transportation	110.00	440.00
Personal	200.00	800.00
	\$2,685.00	\$10,710.00

Living expenses \$420.00 per month (includes Housing, Food, Transportation and Personal).

Students who are married or who have dependent children will, of course, incur greater living expenses.

time, single coverage under ANCHOR is provided at no additional charge.

Graduate Tuition: Full-time students taking from 12 to 16 credits are assessed \$1,250.00 per quarter. Part-time students taking from 1 to 11 credits are assessed \$110 per credit.

While enrolled as either part or full time, single coverage under ANCHOR is provided at no additional charge.

Activity Fee: An activity fee of \$10.00 for full-time students and \$5.00 for part-time students will be assessed fall quarter.

Room and Meals: Since students at Rush University may live in a variety of settings, expenses will vary. Consult the Housing information in the Campus and Student Life section of this Bulletin.

Books: Books and supplies such as lab coats average approximately \$116.00 per quarter for undergraduate students and \$125.00 per quarter for graduate students.

Personal Expenses: Personal expenses typically include insurance, clothing, entertainment, laundry, toiletries, etc.

Transportation: Students should budget about one dollar per day for public transportation.

Parking in the Medical Center garage is \$1.50 per day, or \$45.00 per quarter with a key card. Students coming to the campus from out-of-state should also budget for at least two round trips per year.

Enrollment Deposit: A \$50.00 enrollment deposit is required of all students (including affiliated students) accepted for entrance in fall, prior to matriculation. This assures a place in the entering class. This deposit is non-refundable and applies toward payment of the first quarter tuition.

Application Fee: A non-refundable application fee of \$25.00 must accompany the application.

Readmission Fee: Students who have withdrawn or been dismissed from a program must reapply and pay the \$25.00 readmission fee.

Payment of Tuition and Fees

Tuition and fees are to be paid or satisfactory arrangements for payments made with the Office of Student Financial Affairs before registration is complete. Students may not attend classes until after registration is complete. Any exception to this policy must be approved in writing by the Associate Dean for Academic Support Services.

Students have the responsibility to complete one or a combination of the following courses of action on or before the first day of classes of each quarter.

1. *Pay total tuition and fees for the quarter.*

2. *Complete a Deferred Payment Plan*

Contract. This plan requires that one-third tuition, all fees, and a \$15.00 service charge be paid on or before the first day of classes. Additional payments of one-third tuition are due on the fourth and eighth Monday of the quarter. Forms are available in the Office of Student Financial Affairs.

3. *Complete a Financial Aid Late Payment Form.* This form, initiated by the student and completed by the Financial Aid Office, is to be filed when the student is receiving external aid and when that aid has not arrived at the university by the beginning of the term. This would occur

for example, when a Guaranteed Loan is needed to pay tuition and the proceeds from the bank have not been received by the beginning of the quarter. For that portion of tuition and fees not covered by this external aid, the student must complete step one or two above for the remaining amount. Forms are available in the Office of Student Financial Aid.

Those students who have not made satisfactory arrangements will be given notice by mail during the second week of classes that they are delinquent in their financial obligations to the university. The notification will inform the students that they have until Friday of the third week of classes to satisfy all such financial obligations. On Monday of the fourth week of classes, those students who have not made satisfactory arrangements will be notified that their registration has been canceled for the quarter. Students who choose the Deferred Payment Plan Contract and who fail to make a payment on the specified due dates will have notification mailed to them on Monday of the following week that they are delinquent in their financial obligations to Rush University. The notice will inform the students that they have until Friday of that week to satisfy their financial obligation without penalty, and that fail-

ure to do so will result in the cancellation of their registration for the quarter.

On Monday of the following week all students remaining delinquent under the Deferred Payment Plan will receive final notice that they have been dismissed, and that their dismissal has resulted in forfeiture of all previous payments made.

Any student dismissed under this policy will:

1. Be covered by Anchor/Blue Cross for the remainder of the quarter if the appropriate fees are paid.

Refunds

Official withdrawal from a course, or from the college, entitles a student to a refund of tuition according to the schedule listed below. No other fees are refundable.

A student may receive a 100 per cent refund if withdrawal is during the first calendar week

2. Be dismissed from on-campus student housing.
3. Lose locker and mail privileges.

Students who are reinstated by decision of the associate dean will pay an additional fee of \$25.00.

Students who wish to re-enroll the following quarter or year should contact the Registrar of Rush University.

in which classes begin. Otherwise, refunds will be made as follows:

- Second week—80 percent refund
- Third week—60 percent refund
- Fourth week—40 percent refund
- Fifth week—20 percent refund
- After fifth week—no refund

Financial Aid

Rush University administers its financial aid program without regard to sex, race, color, religion, creed, handicap, age, or country of national origin, and is committed to a program of equal opportunity.

Purpose. The purpose of the financial aid program for students of Rush University is to attempt to provide financial assistance to all admitted students in need of such assistance so that Rush University can be a viable choice of schools for *all* who desire to attend, regardless of financial circumstances. To the extent that they are able, parents and students are expected to provide a degree of support for the student, the expected support being measured under a standard set of criteria by either the College Scholarship Service or the Educational Testing Service. It is the responsibility of the Office of Student Financial Aid at Rush University to attempt to provide and coordinate various programs of financial assistance for the student to make up the difference between what it costs the individual to attend Rush University and what the family and student are reasonably able to contribute towards the student's educational expenses. We are generally able to meet demonstrated financial needs but

such may not always be true for all students. This caveat is particularly true for foreign students, for whom aid is generally more scarce.

Packaged Financial Aid. After considering the family resources and aid awarded to the student by the Basic Grant Program, Illinois State Scholarship Program, and private agencies (where applicable), the Office of Student Financial Aid will attempt to provide additional funds if further demonstrated need exists. Thus various sources of financial aid will need to be drawn upon and brought together in "packaged" form for the individual student. In varying quantities, a financial aid package may include scholarships/grants, loans, and employment.

Application Procedure. For the student to be considered for financial aid from Rush University and to insure that one's potential for aid from outside sources is maximized, the undergraduate student should diligently file the following documents:

1. Rush University application for financial aid, submitted to the Rush University Office of Student Financial Aid.
2. Graduate and Professional School Financial Aid Service statement (GAPSFAS). The Rush University

code number to be used on this form is 3263 for College of Health Sciences students.

3. Illinois State Scholarship Commission (ISSC) Monetary Award application. (Illinois residents without baccalaureate degrees only.) The code number to use is 335.
4. Basic Education Opportunity Grant (BEOG) application. (Undergraduate students without baccalaureate degrees only.)
5. Applications for aid from any outside foundations or agencies for which the student might be eligible. The student should research these possibilities independently as well as in conjunction with the Financial Aid Office. (See Financial Aid Handbook for College of Health Sciences.)
6. Illinois Guaranteed Loan application. (Optional for some students, but necessary for those with high levels of financial need *and* for students with baccalaureate degrees who are not eligible for certain federal and state programs.)
7. Financial Aid Transcript (incoming undergraduate students only). A Financial Aid Transcript must be completed by each school previously attended. Transcript forms are available in the Office of Student Financial Aid.
8. Affidavit of Student Independence signed by parents of self-supporting students only.

NOTE: If the student is independent from parental financial support, the parents need not supply financial information on the GAPS FAS and no parental contribution will be expected. However, in order that the student's responses on the GAPS FAS regarding the following criteria be properly attested to, the parents must nonetheless sign a notarized statement provided by the Office of Student Financial Aid. For a student to be considered independent, the following three criteria must *all* be satisfied:

Scholarships/Grants

The above-outlined application procedure will give the student consideration for programs described below. The student should

1. The student cannot have been claimed as a tax dependent by *anyone* other than self or spouse during both the calendar year previous to and the calendar year itself in which aid is being requested.
2. The student cannot have lived at home of parents or other guardians for more than two consecutive weeks during the period of time in (1) above.
3. The student cannot have received \$600 or more from parents or other guardians during the time period outlined in (1) above.

Renewability of Financial Aid. The student must resubmit *all* financial aid application forms each and every year in which financial aid is being requested. Renewability will be generally contingent both upon the student's having continued financial need and the availability of funds for student aid.

Application Deadline. For the student to receive consideration for aid from Rush University, the above documents should be on file in the Financial Aid Office by May 1 preceding the student's September enrollment. As a result, the student and family should plan to submit the Basic Grant application, Illinois Monetary Award application, and GAPS FAS by early March in order for results to arrive by May 1. The remainder should be on file by May 1. Late applications will be considered for assistance but generally only if funds remain after distribution to on-time applicants. Late applications not the fault of the student will be considered as if received on time. Students admitted after May 1 will be given a reasonable time to complete the application process.

Counseling Services. The Office of Student Financial Aid is available on a daily basis to consult with students and parents on all matters regarding the financing of a Rush University education. Students and parents are welcomed and encouraged to make use of these services.

take care to note whether programs are available for undergraduate or graduate students.

Basic Educational Opportunity Grant Program (BEOG). A federal grant (gift aid) pro-

gram based solely upon the student's financial need, designed to provide the first portion of an undergraduate student's aid package for those students with the greatest need. Awards currently range up to a maximum of \$1,600 per year. Students apply directly to the federally-designated processing agency and receive in return a Student Eligibility Report (SER). The student must then forward this SER to the Financial Aid Office where the amount of the student's award will be computed. This form must be received by the Financial Aid Office before any credit can be issued to the student. If the student is not eligible for an award, one copy of the SER should nonetheless be forwarded to the Financial Aid Office as evidence of the student's having applied for the program. Students who possess a baccalaureate degree are ineligible for the Basic Grant. Applications may be obtained from the Financial Aid Office.

Faculty Wives Scholarship. A scholarship fund for Rush University students has been established by a generous contribution from the wives of the faculty. These scholarships will be awarded on the basis of academic potential and financial need.

Faculty Women's Scholarship. A generous contribution from the women of the Rush University faculty has provided a scholarship fund for female students in Rush University.

Awards are based upon character, academic promise, and financial need.

Illinois State Scholarship Commission (ISSC) Monetary Award Program. A state grant program designed to help meet the financial needs of Illinois students attending the Illinois schools. Awards currently range up to a maximum of \$1,650 per year and are strictly based upon financial need. Students apply directly to the Scholarship Commission and receive notification of status informing them of the level of their award. *Students who have completed more than 225 quarter hours of study or who have attained a baccalaureate degree are ineligible for the State Scholarship Program.* Applications can be obtained from the Financial Aid Office or from:

The Illinois State Scholarship Commission
102 Wilmot Road
Deerfield, Illinois 60015

Rush University Scholarships. A limited number of scholarships generally become available each year through contributions from private donors.

Supplemental Educational Opportunity Grant (SEOG) Program. A federal gift aid program distributed to undergraduate students on the basis of financial need. Only students who have *not* already received a bachelor's degree are eligible.

Loans

Illinois Guaranteed Loan Program: A loan program in which students make application directly to participating lending institutions (banks, savings and loan associations, credit unions, etc.), the State of Illinois acting as guarantee agent for the funds. Eligibility for the principal of the loan is generally determined by the lending institution and loan proceeds are disbursed through the Financial Affairs Office. Often, interest on the loan is paid for the student by the government while the student is in school. Families with adjusted gross incomes of less than \$25,000 per year are automatically eligible for federal interest benefits. Applications are available at the lending institutions.

National Direct Student Loan Program: A campus-based federally-funded program, wherein funds are awarded by the Financial Aid Office to undergraduate and graduate students on the basis of financial need. The principal repayment and interest charges are deferred until 9 months after the student ceases attendance. Interest is at the simply compounded rate of 3 percent per annum. The loan fund under this program is a revolving fund, providing for loan repayments to become future loan funds for other needy students at Rush University.

Employment

College Work-Study Program: A federal student employment program wherein students work part-time to help meet the costs of attendance. Work under this program is approved by the Financial Aid Office and is based upon the financial need of the student.

Institutional Employment: There are some opportunities for the student to work part-time within the institution. The student should be mindful, however, that the academic workload will severely restrict and occasionally preclude one from working during the academic term.

The Graduate School

Executive Committee:

David I. Cheifetz, Ph.D., Dean
Paul E. Carson, M.D.
Rosalind D. Cartwright, Ph.D.
Brenda R. Eisenberg, Ph.D.
Robert S. Eisenberg, Ph.D.
Henry Gewurz, M.D.

Alexander P. Osmand, Ph.D.
Arthur V. Prineas, Ph.D.
Charles L. Schaaf, Ph.D.
Anthony J. Schmidt, Ph.D.
Howard Sky-Peck, Ph.D.
Lauren G. Wolfe, Ph.D.

The Graduate School

General Information

At the present time, the mission of the Graduate School within Rush University is the preparation of graduate students for the degree of Doctor of Philosophy in the basic biological and behavioral sciences. The degree of Doctor of Philosophy is given in recognition of high attainment in a particular field of scientific research, as evidenced by submission of a dissertation showing power of independent investigation and forming a contribution to existing knowledge.

In the newness of its organization, the Graduate School faculty sees the opportunity to avoid the rigidities that often characterize graduate education. A community of scholars should have scholarship as its motivation; disciplinary and departmental boundaries should not limit the setting of a single goal for students, that of excellence in research and its application. The Graduate School faculty hopes to provide individualized and flexible scholarly paths for its students. It wishes to avoid arbitrary imposition of uniformity and the encumbrance of unnecessary formality. It is hoped such an environment will enable students to arrive at the doctoral level still invigorated by ideas. Achievement of such a climate requires adaptation to the needs of students, with the limitation in numbers of students implicit in such an approach.

Administration of Graduate School programs is based on the formation by the faculty of divisions of graduate study. These divi-

sions may be disciplinary or multidisciplinary in character. They come into existence for the sole purpose of providing graduate education; their continued existence is entirely dependent upon their demonstrated ability to provide such education at high levels of excellence. The divisions of the graduate school are seen as being flexible and responsive to changing needs and experiences in their areas of education. To that end, the divisions are headed by directors who serve for definite terms and whose re-appointment is subject to review at periodic intervals. Each division of graduate study is responsible, through its director, to the dean and the Executive Committee, the latter being made up of directors of all graduate divisions, with the dean as chairperson.

Although the dean and the Executive Committee hold ultimate responsibility for programs of the Graduate School, the divisions of graduate study retain significant latitude in structuring and administering their own programs. Aside from general Graduate School requirements, the divisions may, with approval, construct such additional or more specific requirements as their faculties deem desirable. Therefore, this section of the bulletin restricts itself to the statement of general Graduate School requirements. Students interested in admission should consult the program description of the division of their interest to ascertain special divisional requirements.

Resources

Graduate students have available to them the clinical research and instructional facilities of the entire Medical Center. These include the following:

- Within an 18-building Medical Center complex, the clinical resources of Presbyterian-St. Luke's Hospital with 864 beds; a center for the elderly with 176 rehabilitation beds; clinical diagnostic laboratories; an outpatient mental health facility; and the many other clinical and administrative services associated with a large teaching Medical Center.
- The research laboratories of the Medical Center, organized around ongoing faculty

and student research programs in a wide variety of biological, behavioral, medical and surgical areas of inquiry.

- The Electronmicroscopy Laboratory of the Division of Cell Biology.
- The research and study resources of the Academic Facility, a newly completed, \$25.5 million teaching facility containing laboratories, lecture and study halls, carrels, the university library, and a communications skills center.
- The Center for Educational Resources, which supports all instructional activities for faculty and students, including the Library, Learning Resource Center with its audiovisual study carrels, Computer-

Assisted Instruction, Biomedical Communications, and Curriculum and Evaluation.

- The Library of Rush University, which serves the entire university campus, is the oldest medical library in the city of Chicago. It is administered by a staff of professional medical librarians. The library has approximately 80,000 volumes, subscribes to 1,400 periodical titles, borrows documents from inter-library loan, and processes MEDLARS, MEDLINE, and AVLINE requests for patrons. New monographs and reference books are acquired at a rate of over 2,000 each year. The library has an outstanding collection of rare medical books available for research and study.
- The Animal Resources Facility, which provides housing and laboratory services for animals required in ongoing research and teaching.
- Appropriate access to the Data Center of the Medical Center for scientific computer use. Hardware capabilities are built

around an IBM 370/145 system. Software capabilities include APL, a completely interactive terminal-base language; conversational remote job entry available for program development and submission of FORTRAN jobs; International Mathematic and Statistical Library, a complete library of scientific applied mathematical and statistical routines; and other software packages developed for specific purposes, such as SSP and SPSS. By arrangement, consultative services can be obtained from Data Center personnel.

- The Electronics Facility, which serves the clinical and basic science community of the Medical Center with electronic instrumentation design and development capabilities.
- The Research Machine Shop, which provides the Medical Center with the resources necessary for the design and fabrication of experimental devices and mechanical instrumentation.

Admission

Categories of Admission. There are three categories of admission to the Graduate School: (1) regular graduate students, (2) non-degree students, and (3) visiting scholars.

Regular Graduate Students—Students with advanced degree objectives must have the following qualifications to be considered for admission as regular graduate students:

1. They will ordinarily be expected to hold baccalaureate degrees from colleges or universities of recognized standing. Under special circumstances, individuals who do not have baccalaureate degrees will be considered for admission if they have completed studies equivalent to those required for a baccalaureate degree program at Rush.
2. They must show promise, as judged by academic performance and experience, of ability to accomplish advanced study and research and must have adequate preparation in their chosen fields of study. Applicants must submit complete official transcripts of all previous college and university studies.

3. In addition to the above general qualifications, individual divisions of graduate study may specify other qualifications or stipulate particular forms of the general qualifications. Individuals having an interest in admission as regular graduate students should inquire of the individual divisions of graduate study concerning requirements for admission.

Non-degree Students—Such students are not admitted with advanced degree objectives and are not eligible to become candidates for advanced degrees under this classification. Subclassifications are:

1. Temporary Graduate Students—admitted on the basis of the educational services that can be provided them to meet their individual needs, other than degrees. A limited plan of study, for credit but not part of a degree program, may be developed. Auditor's status, not for credit, may also characterize temporary graduate students.
2. International Special Students—limited to *sponsored* foreign students studying in areas to meet objectives not appropriate

for advanced degree programs.

Visiting Scholars—Visiting professors, postdoctoral fellows, and other visiting scholars who have attained doctoral status or the equivalent may attend classes as visitors without payment of fees. This privilege will be granted upon approval by the director of the graduate division in which the work will be done and approval of the dean of the Graduate School. No registration fee is required and no credit is given for courses attended. Persons in this category who wish to receive academic credit must register as graduate students and pay the appropriate fees and tuition.

Non-faculty members of the administrative, instructional, technical, scientific, research, library, and patient care staffs of the Medical Center, who meet the regular requirements for admission to the Graduate School, are eligible to apply for admission as resident graduate students. The amount of graduate work such students may take will be

determined by the terms of their employment. In view of the limited numbers of students admitted to regular graduate status, it must be understood that students applying for full-time residence receive priority.

Rush University faculty members holding professorial rank or classified as instructors may take graduate courses. They may also become candidates for degrees, but approval of their candidacy requires special petition to the dean and consideration by the Graduate School Executive Committee, in addition to the usual steps. In approving such candidacy, the dean will set such additional standards as suit the circumstances, in all cases including the requirement that the candidate's dissertation committee be composed equally of Rush and non-Rush professors, and that the candidate have at least one advisor, in addition to his principal advisor, who is expert in the field of study concerned and is a non-Rush professor.

Admission Requirements

Basic requirements for admission are listed below. Applicants should note that individual divisions of graduate study may have additional requirements. *In all cases*, a student considering application for admission should first establish contact with the director of the division in which he or she plans to study, to determine divisional requirements.

1. An undergraduate record of scholastic excellence is an important consideration. Irrespective of undergraduate record, the process of application review searches for evidence of a high level of creativity and scholarly potential in the applicant.
2. Two copies of the official transcripts of all previous college and university studies must accompany the application for admission. Ordinarily these will include official record of the award of a baccalaureate degree from an accredited school.
3. A non-refundable application fee of \$25.00 must accompany the application. This fee is not refundable under any circumstance, regardless of the outcome of the application. Checks or money orders

should be made payable to the College of Health Sciences. Applicants from outside the U.S.A. must remit the fee either by International Money Order or by a check drawn on a United States bank.

4. Undergraduate major and minor programs of studies should satisfy graduate division requirements.
5. The application must be accompanied by at least three letters of recommendation from college instructors or other supervisors of work in support of the applicant's ability to pursue a scholarly program of independent studies and research.
6. The application must be accompanied by a personal statement in which the applicant indicates his or her reasons for wanting to do graduate work and describes the relevance of his or her goals and academic training to the program to which admission is being sought.
7. Applicants are expected to have decided upon their field of study before making application for admission and to *indicate only one* graduate program on the application form. A second or dual application for a different major for the

same quarter will not be considered. Individuals who are uncertain about their objectives should communicate with the director of each graduate division in which they are interested and submit the application only when a definite choice has been made.

8. A current Graduate Record Examination, testing verbal and quantitative abilities, is strongly recommended. Individual graduate divisions may make this a requirement. Information regarding testing dates and locations may be obtained by writing the Educational Testing Service, Box 995, Princeton, New Jersey 08540. GRE scores should be directed to the graduate division of application.
9. Applicants whose first language is not English, and who cannot otherwise demonstrate their competence in this language, must take the Test of English as a Foreign Language (TOEFL), administered by the Educational Testing Service in some 95 foreign centers.

Applications for the TOEFL Examination may be obtained from the Educational Testing Service, Box 995, Princeton, New Jersey 08540. This is a useful, indeed important, way of helping students determine whether they are well enough prepared to undertake graduate study conducted in English before they make extensive plans for graduate study in the U.S.A.

10. An interview of the applicant may be requested by the graduate division following preliminary review of the application.
11. In view of the competition for the limited number of places in the Graduate School, enrollment applications should ordinarily be completed three months prior to the anticipated date of admission to the graduate division program of choice. Applicants should determine from the director of their chosen graduate division the available entry dates. Some divisions have early deadlines or do not admit each quarter.

Admission Procedure

1. Submission of the application form, accompanied by the following: application fee; transcripts or arrangements for forwarding transcripts; letters of recommendation; personal statement. Application materials should be mailed to:
Graduate School Admissions Office
600 South Paulina Street
Chicago, Illinois 60612
2. At the same time as Step 1 above, submission to the director of the chosen graduate division of the following: evidence in satisfaction of special divisional requirements; indication of forwarding of GRE scores as provided or required; indication of forwarding of TOEFL results as required.
3. In the early stages of processing the application, the student will be notified whether the application is complete or incomplete in the Graduate School Admissions Office. If it is incomplete, the missing items will be designated. If acknowledgement of receipt of application is not received within a reasonable

period of time (four weeks), the applicant should inquire about the status of the admission file.

Processing by the Graduate School Admissions Office is limited to ascertaining that the file of required materials is complete and that the applicant meets the general requirements of the Graduate School for admission. As soon as this is accomplished, all the application materials are referred to the graduate division. There they are subjected to a more specific and intensive review.

4. The graduate division will review all materials and request such additions or clarifications as may be indicated. Following such review, the director of the graduate division will recommend to the Executive Committee of the Graduate School and the dean action to be taken concerning admission of the applicant.
5. Notification to the applicant of action taken will come from the Office of the Dean. Although it is expected that applicants and graduate divisions will have extensive contact with one another, the

Office of the Dean alone is empowered to make the formal offer of admission, taking the recommendations of the division and the executive committee into full consideration. The applicant should not rely upon receiving a response to the applica-

tion, by way of acceptance or rejection, on or before any specific date after it has been referred to the division, nor should the applicant construe a lack of response as an intention to act favorably on the application.

Ph.D. Degree Regulations

The degree of doctor of philosophy is the highest earned degree conferred by Rush University. The Ph.D. is restricted to those scholars who have demonstrated superior ability in a recognized academic discipline. The Ph.D. degree is not awarded on the basis of time spent in residence, or following the completion of any specific number of formal courses, nor is the degree granted on the basis of miscellaneous course studies and research effort. The entire Ph.D. program must be rationally related, should be highly research-oriented, and should culminate in a thesis of literary and scholarly merit which is indicative of the candidate's ability to conduct original research in a recognized field of specialization. Ph.D. programs are directed by professors who work in close association with selected graduate students. In practice, such programs are composed of formal courses, guided individual study in a chosen field or discipline, study in such cognate subjects as may be required by the candidate's advisory committee, and original research that serves as the basis of a scholarly thesis.

For the most part, specific regulations governing the process which results in final award of the degree are developed by the graduate divisions responsible for the candidate's progress. While such regulations may differ in detail from one division to another, each division's program and regulations must be reviewed for approval by the Executive Committee of the Graduate School. In all cases, graduate divisions are required to be explicit and clear about regulations that will affect the candidate. This must be stringently observed in divisional regulations concerning selection of principal advisors, advisory committees, and a plan of study. Similarly, divisions will be explicit and clear concerning procedures surrounding qualifying, preliminary, and final examinations and will also be

responsible for providing the candidate with the help and information needed to plan and conduct the thesis research.

At the same time, a major responsibility lies with the student to become familiar with the regulations and expectations of his or her chosen division. These regulations and expectations are included in this bulletin within the section devoted to each individual divisional program. It is considered to be the student's responsibility to remain knowledgeable about these programmatic regulations as they are set forth; they may change from time to time.

Policies and regulations applicable to all students are listed below:

- Rush University considers students for admission and academic progression without regard to religion, creed, or country of national origin, and is committed to a program of equal opportunity.
- Years of residence required by divisional programs are based on the definition that a student must be registered for a minimum of three subjects in each of three quarters to satisfy the Graduate School requirement of a resident year. Graduate School residency required of all graduate students is registration as a full time student for eight quarters. Unless granted a formal leave of absence, regular graduate students who fail to register for three quarters in each academic year are considered to have withdrawn from the Graduate School and must compete for readmission with all other applicants.
- For the Ph.D. degree there is no general Graduate School requirement of a foreign language. This requirement is determined by each division. Among the options decided by each division, where knowledge of another language is required, are the following: the number of foreign languages required, which foreign languages are acceptable, the type of skill

required in acceptable foreign languages, whether satisfaction of a foreign language at another graduate school or at an undergraduate college is transferable, and whether a non-English native language is acceptable.

- Some divisional programs may require the student to take one or more courses at a university other than Rush. It is the responsibility of the director of the graduate division concerned to make arrangements enabling satisfaction of such course requirements and to inform the student, prior to admission, of such costs and special arrangements as may be necessary.
- The quarter hour is the unit used by the Graduate School in determining credit for courses taken at the Rush University campus. One quarter hour generally represents a lecture or seminar meeting one hour each week, or a laboratory or clinical experience of two to three hours per week (sometimes more) for the ten weeks of the quarter. Full-time graduate residence requires at least 12 and not more than 16 quarter hours per quarter. Outstanding students may petition the division director and the dean to register for additional courses. Written approval is required. Degree candidates must also obtain written permission for less than full-time residence.
- Graduate level courses taken at any recognized institution may be applied to the doctor of philosophy degree at Rush if they are judged to meet divisional requirements, subject to the approval of the major advisor and the division director.

Credit in excess of nine quarter hours requires approval by the division director and the dean. Grades from courses transferred from another institution are not recorded on the student's academic record; the number of credits is recorded and added to the cumulative number of credits.

- Grades used to report the quality of a graduate student's work are:

Grade	Explanation	Grade Points
A	Performance at a superior level	4
B	Performance at a level sufficiently high for a graduate degree	3
C	Performance not consistently at the level needed for a graduate degree	2
D	Barely passing	1
F	Unsatisfactory performance	0
I	Incomplete work	—
W	Withdrawal	—
P	Passing	—

To be applied toward the Doctor of Philosophy degree, required courses must be passed with a grade of A or B. With the approval of the division director and course director, students may register for elective courses on a Pass-Fail basis.

- The faculty reserves the right to request the withdrawal of any student whose conduct, health, or performance, demonstrates lack of fitness for continuation in the degree program.

Financial Affairs

Expenses. Expenses listed in this section apply to all students in graduate programs. All expenses listed in this section are current estimates of costs levels as of the beginning of Fall term 1978. The actual charge of tuition and fees is subject to change without notice, and other budgetary costs used in the deter-

mination of financial aid eligibility may also vary somewhat. Institutions utilizing Federal Aid funds, including Rush, derive living expense levels based upon Bureau of Labor Statistics at the moderate level. Students on Financial Aid must conform their living expenses to these allowable budgets.

The estimated expenses for a full-time single graduate student in the College of Health Sciences are as follows:

	per quarter	per academic year of four quarters
Tuition	\$1,250.00	\$ 5,000.00
Activity Fee	10.00	10.00
Insurance	40.00	160.00
Books and Supplies	125.00	500.00
Housing and Utilities	700.00	2,800.00
Food	250.00	1,000.00
Transportation	110.00	440.00
Personal	200.00	800.00
	\$2,685.00	\$10,710.00

Description of Expense Categories

Tuition: Full-time students taking from 12 to 16 credits are assessed \$1,250.00 per quarter. Part-time students taking from 1 to 11 credits are assessed \$110.00 per credit. While enrolled as either part or full-time, single coverage under ANCHOR is provided at no additional charge.

Activity Fee: An activity fee of \$10.00 for full-time students and \$5.00 for part-time students will be assessed fall quarter.

Room and Meals: Since students at Rush University may live in a variety of settings, expenses will vary. Consult the Housing information in the Campus and Student Life section of this bulletin.

Books: Books and supplies such as lab coats average approximately \$125.00 per quarter.

Personal Expenses: Personal expenses typically include insurance, clothing, entertainment, laundry, toiletries, etc.

[Living expenses \$420.00 per month (includes Housing, Food, Transportation and Personal).]

Students who are married or who have dependent children will, of course, incur greater living expenses.

Transportation: Students should budget about one dollar per day for public transportation. Parking in the Medical Center garage is \$1.50 per day, or \$45.00 per quarter with a key card. Students coming to the campus from out-of-state should also budget for at least two round trips per year.

Enrollment Deposit: A \$50.00 enrollment deposit is required of all students accepted for entrance in fall, prior to matriculation. This assures a place in the entering class. This deposit is non-refundable and applies toward payment of the first quarter tuition.

Application Fee: A non-refundable application fee of \$25.00 must accompany the application.

Readmission Fee: Students who have withdrawn or been dismissed from a program must reapply and pay the \$25.00 readmission fee.

Payment of Tuition and Fees

Tuition and fees are to be paid or satisfactory arrangements for payment made with the Office of Student Financial Affairs before registration is complete. Students may not attend classes until after they have completed registration. Any exception to this policy must be approved in writing by the Office of the President.

No transcripts or degrees will be issued for a student who has not made satisfactory arrangements for payment of any financial obligations to Rush-Presbyterian-St. Luke's Medical Center.

Students have the responsibility to complete one or a combination of the following courses of action by Friday of the first week

of classes to avoid dismissal from the university for nonpayment of tuition and fees:

1. Pay total tuition and fees for the quarter.
2. Complete a Deferred Payment Plan Contract. This plan requires that one-third tuition, all fees, and a \$15.00 service charge be paid by Friday of the first week of classes. Additional payments of one-third tuition are due on the fourth and eighth Monday of the quarter. Forms are available in the office of Student Financial Affairs.
3. Complete a Financial Aid Late Payment Form. This form, initiated by the student and completed by the Financial Aid Office, is to be filed when the student is receiving external aid and when that aid has not arrived at the university by the beginning of the term. This would occur, for example, when a Guaranteed Loan is needed to pay tuition and the proceeds from the bank have not been received by the beginning of the quarter. For that portion of tuition and fees not covered by this external aid, the student must complete step one or two above for the remaining amount. Forms are available in the Office of Student Financial Aid.

Those students who have not made satisfactory arrangements will be informed on Monday of the second week of classes, or as soon as possible thereafter, that they are in the process of being dismissed from the university. However, the notification will also inform the students that they can reverse this procedure with no penalty upon making satisfactory arrangements as specified above, by

Friday of the second week of classes. Those students who do not make satisfactory arrangements will be dismissed from the university, and their names will be removed from final class rosters. Such students will not be admitted to clinical, laboratory, or didactic class sessions.

Students who do not comply with this last opportunity for making satisfactory arrangements will be assessed 20 percent of tuition, which is the amount charged to those who withdraw for any reason during the second week of classes.

Students who choose the Deferred Payment Plan Contract and who fail to make a payment on the specified due dates have until Friday of the week in which payment is due to make the payment. On Monday of the following week, they will be notified that they have been dismissed and have until Friday to make the payment and be reinstated with no penalty. Failure to make payment results in dismissal from the university, forfeiture of credit for the quarter, and forfeiture of any previous payments made.

Students who wish to reenroll the following quarter of year should contact the Registrar of Rush University.

Any student dismissed under this policy will:

1. Be covered by Anchor/Blue Cross for the remainder of the quarter if the appropriate fees are paid (see Health Services and Counseling).
2. Be dismissed from on-campus student housing.
3. Lose locker and mail privileges.

Refunds

Official withdrawal from a course, or from the college, entitles a student to a refund of tuition according to the schedule listed below. No other fees are refundable.

A student may receive a 100 per cent refund if withdrawal is during the first calendar week

in which classes begin. Otherwise, refunds will be made as follows:

- Second week—80 percent refund
- Third week—60 percent refund
- Fourth week—40 percent refund
- Fifth week—20 percent refund
- After fifth week—no refund

Financial Aid

Rush University administers its financial aid program without regard to sex, race, color,

religion, creed, handicap, age or country of national origin, and is committed to a program of equal opportunity.

Graduate Students of the Graduate School

Purpose. The purpose of the financial aid program for graduate students at Rush University is to attempt to provide sufficient assistance to students to allow them to attend at the graduate level. Such assistance will generally be based upon the financial need of the student, though academic factors will be closely weighed. In addition to providing funds, certain types of assistance are intended to provide meaningful experience for the student as well as service to the institution.

Application Procedures

1. Submit a Rush University application for financial aid to the Office of the Dean of the College of Health Sciences. It will thereafter be forwarded to the Rush University Office of Student Financial Aid.
2. Submit a Graduate and Professional School Financial Aid Service statement (GAPSFAS). The Rush University code number to be used is 3263 for students in the College of Health Sciences.
3. At the option of the student, submit an application for an Illinois Guaranteed Loan. This program takes on increasing significance when federal and other pro-

grams are being funded at low levels. In this regard, the student may wish to seek counseling from the Financial Aid Office at an early date.

Application Deadline. For the student to receive the most favorable consideration for aid from Rush University, the applications should be on file by May 1 preceding the student's fall enrollment. Late applications will be considered on a rolling basis if funds remain after the distribution to on-time applicants. Students admitted after May 1 or for enrollment other than at the beginning of the Fall term, and who have not completed the application process will be given a reasonable time to do so.

Renewability of Financial Aid. A student's financial aid will generally be renewed each quarter, if funds permit, and if the student remains in good academic standing and continues to have financial need.

Counseling Services. The Office of Student Financial Aid is available on a daily basis to assist students with financial planning and resource availability. Students are welcomed and encouraged to make use of these services.

Scholarships/Grants

The above-outlined application procedure will give the student in the College of Health Sciences Graduate School consideration for programs described below in alphabetical order.

Broda O. Barnes Fellowship. A fellowship has been established for a deserving and meritorious student enrolled in the doctoral program of the Division of Physiology, to be awarded by the Chairman, Department of Physiology.

Broda O. Barnes Fellowship in Memory of Anton J. Carlson and Arno B. Luckhardt. A fellowship has been established for a deserving and meritorious graduate student in the College of Health Sciences, to be awarded by the dean of the College of Health Sciences.

Faculty Wives Scholarship. A scholarship fund for Rush University students has been established by a generous contribution from the wives of the faculty. These scholarships

will be awarded on the basis of academic potential and financial need.

Graduate Assistantships. These represent funds generally obtained through grants to individual faculty and, as such, vary in amount from division to division, although they generally are uniform within a division.

Graduate Traineeships. Certain divisional programs with NSF training grants or NIH National Research Service Awards may from time to time have positions to be filled on such grants. In addition, graduate students may directly apply to NSF or NIH for such support. All such individuals will be classed as graduate trainees.

Rush University Scholarships. A limited number of scholarships generally become available each year through contributions from private donors.

Senior Graduate Assistantships. Upon admission to candidacy, and subject to availability of funds within divisions, grad-

uate students may apply for these awards. Generally the intent is to supplement the stipend levels of graduate students showing unusual responsibility, promise, and ability beyond the levels provided for by the research assistantships.

Teaching Assistantships. These represent funds available to support graduate students

in return for teaching services rendered to specific departments.

University Fellowships. These represent funds available to students through the College of Health Sciences. Amounts will depend on financial need and availability of funds. There will be no variation in the amount of the award between divisions.

Loans

Illinois Guaranteed Loan Program. A loan program in which students make applications directly to participating lending institutions (banks, savings and loan associations, credit unions, etc.), the State of Illinois acting as guarantee agent for the funds. Eligibility for the principal of the loan is generally determined by the lending institution, and loan proceeds are disbursed by the lending institution through the Financial Aid Office. Often, interest on the loan is paid for the student by the government while the student is in school. Families with adjusted gross incomes of less than \$25,000 per year are automatically eligi-

ble for federal interest benefits. Applications are available at the lending institutions.

National Direct Student Loan Program. A campus-based federally funded loan program, wherein funds are awarded by the Financial Aid Office to students on the basis of financial need. The principal repayment and interest charges are deferred until nine months after the student ceases attendance. Interest is at the simply compounded rate of 3 percent per annum. The loan fund under this program is a revolving fund, providing for loan repayments to become future loan funds for other needy students.

Employment

College Work-Study Program. A federal student employment program wherein students work part-time to help meet the costs of attendance. Employment under this program is approved by the Office of Student Financial Aid and is based upon the financial need of the applicant.

Institutional Employment. Some opportunities exist for the student to work part-time within the institution. The student should be mindful, however, that the academic workload will severely restrict and occasionally preclude one from working during the academic term.



Divisional Programs

(Programs in addition to those described are in process of active development)

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Graduate Division of Anatomical Sciences

Anthony J. Schmidt, Ph.D., Director

Faculty

Andriacchi, T.	Durica, T.	Khedroo, L.	Seale, R.
Colgan, J.	Galante, J.	Maibenco, H.	
Dinsmore, C.	Hughes, W.	Schmidt, A.	

Program Outline

The Division of Anatomical Sciences offers an interdepartmental program of studies in the morphological sciences, dealing with the development, organization, and function of biological structure. The curricular center is in the Department of Anatomy, whose offices and laboratories are housed in the Academic Facility. This framework is complemented by faculty with a wide range of teaching and	research interests, providing opportunities for the advanced student to engage in creative scholarship in an atmosphere that fosters intellectual growth. The participating faculty is drawn from a broad sector of the Biological, Medical, and Surgical Sciences and Services of the Medical Center, and specifically from Anatomy, Ophthalmology, and Orthopedic Surgery.
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Facilities

Modern research and teaching areas in the Academic Facility have been designed specifically to meet the needs of both basic medical science education and research. In addition to individual faculty laboratories, the department has developed three special purpose facilities for research, one serving microsurgery, incubations and organ cul-	tures; a second for bioassays; and a third for microtomy. A modern facility is available for transmission electron microscopy, and extensive research laboratories exist in Rawson (Ophthalmology), and in Jelke (Orthopedic Surgery) where the Gait Laboratory, one of the very few such major facilities in the country is in operation.
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Objectives

Graduate study is offered at the doctoral level. Progress is evaluated with respect to course work and the conduct of a thesis project. It is the purpose of the graduate study program to: 1) provide background in those courses that constitute the core of anatomy curricula in graduate and medical school;	2) encourage conceptual development in specialized areas through elective courses in cytology, developmental biology, regeneration, biomechanics, reproductive biology, endocrinology, and neurobiology; 3) define problems which are amenable to experimental or applied studies.
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Application and Admission

Applications are invited from students who have received prior graduate training or an advanced degree elsewhere, and who wish to pursue graduate study in the anatomical sciences at Rush University; and to the superior student enrolled in the medical curriculum or in other professional programs in Rush University. The exceptional medical student may combine graduate studies with the Rush medical curriculum and, though possible to earn both the M.D. and Ph.D. degrees after four years of study, students will generally find it necessary to continue their graduate studies beyond the fourth medical year.	To afford students who previously have taken course work in anatomy at Rush or elsewhere the opportunity of entertaining advanced placement, the Division Program Director and Graduate Studies Committee may (1) review the student's prior achievement in courses comparable to the formal anatomy curriculum, or (2) offer a proficiency examination in one or more courses for credit. In either case credit in excess of nine (9) quarter hours requires approval by the program director and the dean. However, under no circumstances can a student receive more than one academic year of advanced standing in the graduate program of the division. Accordingly, the student receiving advanced
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placement should expect to engage in graduate studies for a minimum residency of eight quarters of full time registration in the Graduate School.

The professional student must accept responsibility for meeting all of the requirements for progress and graduation in the division's graduate studies program. These include mastering recommended course work and successfully passing the division's comprehensive qualifying, preliminary, and final examinations. In this regard individualized studies will be programmed to meet the student's need in achieving essential knowledge in preparation toward these examinations and skills for scholarly investigation.

Inquiries should be directed to:

Graduate Admissions Office
600 South Paulina Street
Room 474 M
Chicago, Illinois 60612

In addition to the admission requirements established by the Graduate School, the Division asks applicants to send documents supporting:

1. An undergraduate record of scholastic excellence with a minimum of a B average or its equivalent in the major field of study. Application by students who have demonstrated a high level of creativity and scholarly potential is solicited.

2. A major, preferably in biology or chemistry, and demonstrated academic competence and motivation for a career in the morphological sciences. Undergraduate training should have included a laboratory in comparative anatomy. Courses in descriptive and experimental embryology would be helpful.
3. A current Graduate Record Examination (GRE) testing verbal and quantitative abilities, and either biology or chemistry. Exemption from the GRE may be considered at the discretion of the Graduate Studies Committee.
4. In view of the competition for the limited number of places in the Graduate School enrollment, applications should ordinarily be completed three months prior to anticipated date of admission. Summer and fall quarter admissions are preferred by the division.

The completed application initially will be evaluated by the program director and Graduate Studies Committee of the division. A personal interview may be requested following the preliminary review of an applicant's credentials. The completed application is then presented to the Dean and Executive Committee of the Graduate School to determine the course of action to be taken by the Office of the Dean.

Program Leading to the Ph.D. Degree Outline

The student must accept responsibility for meeting all of the requirements for progress and graduation in the division's graduate studies program. These include mastering recommended course work and successfully passing the division's comprehensive qualifying, preliminary, and final examination. In this regard individualized studies will be programmed to meet the student's need in achieving essential knowledge in preparation toward

these examinations and skills for scholarly investigation.

An acceptable thesis must be searched and prepared by the student. Dissertations will be developed through faculty guided independent research projects. Interdisciplinary problems and approaches may be pursued in the laboratory, including the clinical diagnostic laboratory, and in the realm of applied biology (excluding purely clinical observation or equivalent reporting).

Course Requirements

The formal electives and dissertation requirements are as follows:

1. *Courses of Study.* A minimum of 72 quarter hours is required.

Required: The formal courses in anatomical sciences include instruction in 1) gross human anatomy, 2) microscopic anatomy, 3) embryology, 4) neuroanatomy, 5) methods in morphological research.

Electives: Major electives are a minimum of three advanced topics selected for personal interest and need in preparation for thesis research. These are primarily delivered as seminars, tutorials, and, in some instances, laboratory instruction.

Minor electives are a minimum of two advanced topics in complementary areas of study.

2. *Research:* A minimum of 72 quarter hours required in pursuit of dissertation research under the guidance of a principal adviser. Additional registration is open to serve individual needs.

The division's professional-graduate studies program centers on the Rush Medical College curriculum. In our experience, students in the Phase I and Phase II medical curriculum can devote an additional 12-18 hours contact time a week to graduate studies.

Phase I Medical Curriculum. In the first year of study, and including the summer quarter, the student can complete all formal course requirements, gain graduate credit applicable toward satisfying the minor elective require-

ment, initiate a research project, and take the qualifying comprehensive disciplinary examination.

Courses: gross and microscopic human anatomy, embryology, neurobiology, biochemistry, microbiology, physiology, and elective graduate courses (63 quarter hours).

Research: may begin in the summer quarter (12 quarter hours).

Phase II Medical Curriculum. Continuing studies will provide additional graduate credits that satisfy all course requirements and broaden the student's conceptual and research experience. The preliminary examination may be taken at the end of this period.

Courses: pathology, pharmacology, immunology, genetics, and elective graduate courses (53 quarter hours).

Research: continuation of research begun earlier (9 quarter hours).

Phase III Medical Curriculum. The clerkship program of Rush Medical College is conducted in a ninety-six (96) week period following Phase II. The medical student is required to take a series of core clinical clerkships (56 weeks), followed by elective clerkships (24 weeks), and unscheduled time (16 weeks). There is flexibility within the clerkship program that allows students who are concomitantly enrolled in graduate studies to entertain the option of taking all rotating core and elective clinical clerkships in Presbyterian-St. Luke's Hospital and its vicinity, enabling them to simultaneously pursue their graduate program. As stated in the Rush Medical College 1977-79 catalogue (p. 21), "The student and his or her principal

adviser may also modify or generate personalized clinical or research experiences to fit individual goals.”

Enrollment in formal courses is not expected during the core clinical clerkships though it may be possible for students to engage in tutorials offered through *Anatomy 556 Concepts in Morphology* (1-3 hrs.), and likely to continue some portion of an ongoing research program. Maximum credit students may enroll for is 6 qtr. hrs. per quarter.

It is during the elective and unscheduled periods that a student pursuing a concomitant Ph.D. degree may elect to take essential graduate courses and continue dissertation research in addition to engaging in elective clerkships to fit individual goals.

The total research credit hours (72 hours

minimum) requirement may be satisfied during Phase III, and the final examination in defense of the thesis may be taken following acceptance of the dissertation by the Dean of the Graduate School.

In addition to the formal course requirements, each student will be expected to assist in the instructional process within the Division of Anatomical Sciences thereby gaining invaluable pedagogic experience. The student should participate as a teaching assistant at least once in each of the formal courses.

Also, student attendance and participation in Divisional Seminars is expected. This will not only expose the student to current topics in anatomical research, but will also present opportunities to discuss problems with established investigators.

Assessment of Progress

The student's progress will be assessed continuously based upon performance in the courses taken and upon evaluations by faculty members.

Students who fail to maintain scholastic standards of the division (GPA = B) and of the Graduate School will be placed on probation as a warning with opportunity to improve. Failure to improve for two consecutive quarters of probation may be cause for dismissal.

Qualifying Examination: At the end of the first year, each student will take a comprehensive examination covering the formal courses in the division. The format of this examination will be both a written essay and oral

presentation affording the student the opportunity to demonstrate an understanding of the interrelationship of the various levels of anatomical studies. The examining committee will be designated annually by the Graduate Studies Committee. The successful completion of this examination qualifies the student to continue studies toward the doctoral degree. Failure to pass will require determination by Graduate Studies Committee, upon the advice of the student's advisory committee, of whether or not a second and final opportunity be offered the student.

Upon such recommendation, a second examination may be taken at a mutually satisfactory time within six (6) months of the initial comprehensive discipline examination.

Graduate Advisory Committee

Each entering student will be guided in his or her course of studies by the program director with the assistance of the Graduate Studies Committee until such time as the student determines a course of thesis scholarship. Students will be expected to reach an appropriate decision early in their first year and no later than the final week of the fourth quarter. At this time, an advisory committee will be formed to guide and counsel the student in his/her graduate education.

The advisory committee will consist of a principal adviser, two associate advisers, and

the program director, who acts as an *ex officio* adviser. The principal adviser must be an active member of the graduate faculty and will be selected on the basis of mutual agreement and scholarly compatibility between the student and the principal adviser. In the event that the student does not establish himself/herself with an acceptable adviser during the first academic year (9 months), the program director, with the assistance of the Graduate Studies Committee, will counsel the student and determine alternatives, one of which could be termination of studies within the Division.

Principal Adviser. Every graduate student must have a principal adviser who is a member of the graduate faculty holding appointment in the Division of Anatomical Sciences of the Rush Graduate School.

The principal adviser's primary duty is to assist the student in planning and carrying through a program of graduate work which will fit the needs and desires of the student

and at the same time satisfy division and Graduate School requirements.

The dissertation research may be guided by the principal adviser, or, in the event the thesis research is to be conducted elsewhere, the investigator responsible for the external laboratory will become a member of the student's advisory committee with the approval of the program director and Graduate School.

Thesis Proposal and Preliminary Examination

Thesis Proposal: Following successful completion of the comprehensive discipline examination and when the principal adviser and student are satisfied that the student is able to demonstrate both integrative and analytical comprehension in his/her field of specialization, the student will prepare a written thesis proposal. This proposal will then be defended as part of an oral preliminary examination relating to the student's field of specialization.

Preliminary Examination: An oral preliminary examination will be administered by an examining committee ordinarily at or prior to the end of the second academic year and no later than the end of the third academic year following admission to the division program.

The committee will examine the student's proposal in depth as well as his/her grasp of all areas relevant to the research project. Should the student fail to pass the preliminary examination, a second and final examination may be held within three months upon the recommendation of the program director with the approval of the Graduate Studies Committee. Failure to pass the second examination may be grounds for dismissal.

The examining committee consists of a minimum of four faculty approved by the program director and Graduate Studies Commission. The examining committee includes the designated principal adviser, associate advisers, and at least one extramural examiner.

Thesis and Final Examination

Dissertation: The dissertation will consist of a written scholarly work based upon an original thesis research project. It should be presented in the format determined by the Graduate School.

The scheduling of the dissertation review by the advisory committee, and by the dean, must comply with the requirements of the Graduate School.

Final Examination: The final examination may be taken upon acceptance of the dissertation by the Dean of the Graduate School, and must precede the projected date of graduation in accordance with a schedule determined by the Graduate School.

Oral defense of the dissertation serves as the final examination in partial completion of the requirements for Doctor of Philosophy degree.

The examining committee consists of a minimum of five faculty approved by the program director and Graduate Studies Committee. At least three examiners, including the student's principal and associate advisers, will be selected from within the division. Two examiners may be selected from outside the division preferably, though not necessarily, from outside the university. Distinguished scientists may be invited as guests of the department to examine the dissertation and to participate in the final oral defense.

Passing the final examination is based upon the recommendation of the majority of the examiners. In the event that the student fails to pass the final examination, the student may appeal to the Dean of the Graduate School who, upon consultation with all parties concerned, may recommend a course of action to be taken.

Course Offerings

A. The following courses are fundamental to the graduate program of the Division and are to be taken by all graduate students.

ANAT 455, 456

Histology. An introduction to the use of the microscope. The microscopic anatomy of cells, tissues, and organ systems of the human body is studied through laboratories, lectures, and preceptorials. Special attention is given to the fine structural anatomy of cell organelles and individual specializations revealed by the electron microscope. Functional and clinical correlations are emphasized.

Staff — fall and winter quarters. 40 hours each.

Director: Schmidt

ANAT 471

Human Anatomy I. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Laboratory dissection is conducted regionally, encompassing the thorax, abdomen, pelvis, perineum, head and neck, back, and extremities. Radiological anatomy, living anatomy, and clinical correlations are emphasized.

Embryology. The fundamentals of human development are examined from gametogenesis and fertilization through the formation and differentiation of the germ layers, organogenesis, and morphogenesis of the fetus. Congenital malformations and experimental embryology are introduced where feasible.

Staff — fall quarter. 100 hours

Director: Schmidt

ANAT 472

Human Anatomy II. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Embryology is introduced where pertinent. Continuation of ANAT 471.

Staff — winter quarter. 100 hours

Director: Schmidt

NEURO 451

Neurobiology. (see ANAT 451 and 452).

Staff — spring quarter. 80 hours

Director: Klawans

ANAT 451

Neuroanatomy. The morphological organization of the central nervous system is explored through lectures, preceptorials, laboratory dissection and microscopic examination of human brains and spinal cords (also NEURO 451 — Rush College of Medicine).

Staff — spring quarter. 40 hours

ANAT 452

Functional Neuroanatomy. In parallel with ANAT 451 is the physiology of the normal nervous system and an integrated introduction to the neurochemistry and pathophysiology of diseases of the central nervous system. A series of lectures in basic neurophysiology and neurology, with laboratory in neurophysiology (also NEURO 451 — Rush College of Medicine).

Staff — spring quarter. 40 hours

ANAT 581

Approaches and Methods in Morphologic Research. Study of how sources of information, methods of investigation, and technical procedures are applied to anatomic research. Demonstrations of techniques and student laboratory participation is included.

Staff — 60 hours, 4 quarter hours

ANAT 591

Preceptorials in Anatomy. Laboratory experience is provided in conjunction with related preceptorials on selected topics in the anatomical sciences.

Prerequisites: ANAT 471-2, 455-6, 451-2

Staff — 40 hours, 1-3 quarter hours

ANAT 699

Research. Research devoted to the preparation of a thesis in partial fulfillment of the requirements of the degree program.

Staff — 1-16 quarter hours

B. Electives in special topics available to graduate students, subject to demand, limitations, and such prerequisites, as specified.

ANAT 511

Functional Cytology. Study of cellular structure and the application of special techniques will include emphasis on the development of technology and the evolution of contemporary views on the structure and function of tissue components.

Staff—Colgan and Hughes. 40 hours, 3 quarter hours

ANAT 512

Scientific Basis of Electron Microscopy. This course provides facts about electron microscopy where possible and practical approaches where not. Techniques include the chemical basis of fixation; size and shape changes during fixation, dehydration, and embedding; plastic and frozen thin sectioning; selective staining and immunocytochemistry; autoradiography. We will also discuss the physics of electron optics and the theory of transmission, scanning, high voltage, and x-ray detection electron microscopy. Same as CEB10 512. (4-0-4)

ANAT 521

Experimental Morphogenesis. Problems related to normal growth and especially the genesis of complex form will be explored in detail. The class will initially entertain basic concepts in growth and growth regulation. Students will then prepare, present, and analyze current publications on specific morphogenetic problems. Independent research projects will be encouraged where feasible.

Prerequisite: Anatomy 471-2, 455-6

Staff—Dinsmore and Schmidt. 40 hours, 4 quarter hours

ANAT 522

Causal Analysis of Tissue Repair and Reconstitution. The variable ability of mammalian and non-mammalian tissues to repair and to reconstitute themselves will be considered. Original papers on cellular determination, differentiation, cell turnover, and other select topics will form the nucleus of seminar discussions.

Prerequisites: ANAT 455, 456, or permission of the instructor

Staff—Dinsmore and Schmidt. 40 hours, 3 quarter hours

ANAT 523

Cell Biology of Vertebrate Repair and Regeneration. Analysis of cytoarchitectural concepts of amphibian appendage regeneration correlated with molecular basis of specific tissue responses to trauma examined principally from histochemical-cytochemical data. This, in turn, will be correlated with tissue repair mechanisms common to all vertebrates. Lectures, preceptorials, and laboratory.

Staff—Dinsmore and Schmidt. 40 hours, 3 quarter hours

ANAT 524

Morphologic and Physiologic Adaptations in Development, Maturity, Aging, and Injury. Analysis of biologic structure and function during vertebrate growth and development and the response of these factors to aging and trauma.

Staff—Maibenco. 40 hours, 4 quarter hours

ANAT 462

Introduction to Neurobiology. The development, morphology, and functional significance of the human nervous system is presented in lecture and by demonstrations. Fixed human brain preparations and series of neurological slides are used as visual aid materials. Consent of instructor is required.

Staff—Hughes, Maibenco, Schmidt. 60 hours, 4 quarter hours

ANAT 560

Topics in Neurobiology. A seminar format will be utilized to review selected topics and original papers within one of the following units of study: 1) neurogenesis, 2) synaptic organization of neural systems, or 3) current methods in neuroanatomy research.

Staff—Durica, Hughes, staff. 40 hours, 4 quarter hours

ANAT 463

Neurologic Aspects of Patient Care. The physiologic factors underlying pain, consciousness, and sleep are discussed, as well as the signs and symptoms of common neurologic disorders. The subject material is presented by means of lectures, demonstrations, and visual aids.

Prerequisite: ANAT 462

Staff—Maibenco. 20 hours, 1 quarter hour

ANAT 541

Mechanisms of Excitation and Contraction.

A seminar format will be employed for critical examination of papers relating to the structure and function of muscle. Current topics in excitation-contraction coupling, contractility, and energetics will be explored. Topics will be announced prior to the beginning of the course.

Prerequisites: ANAT 455-56, Physiology, and the consent of the instructor

Staff—Colgan. 40 hours, 4 quarter hours

ANAT 542

Neuromuscular Interactions. A review of the fine structure, physiology, and pharmacology of the neuromuscular junction will be followed by examination of experimental systems dealing with the trophic maintenance and the development of muscle fiber types. Contributions of nerve injury to the pathogenesis of muscle disease will be considered.

Staff—Hughes. 40 hours, 4 quarter hours.

ANAT 513

Anatomy of the Eye. The histology and embryology of the eye will be reviewed in detail as the basis for discussion of selected topics. These will include congenital malformations, physiology and pharmacology of

selected ocular systems, vessels and nerves of the orbit, regional structure and function.

Staff—Hughes. 40 hours, 4 quarter hours.

ANAT 593

Concepts in Morphology. Seminars and tutorials offered by faculty and guests on topics of special interests in the morphological sciences.

Staff—staff. 10-40 hours, 1-4 quarter hours.

ANAT 601

Surgical Anatomy. A laboratory program of regional dissections and demonstrations. The applied, clinical, and surgical aspects of anatomical regions is emphasized.

Prerequisites: ANAT 471, 472 or equivalent

Director: Doolas. 30 hours, 3 quarter hours.

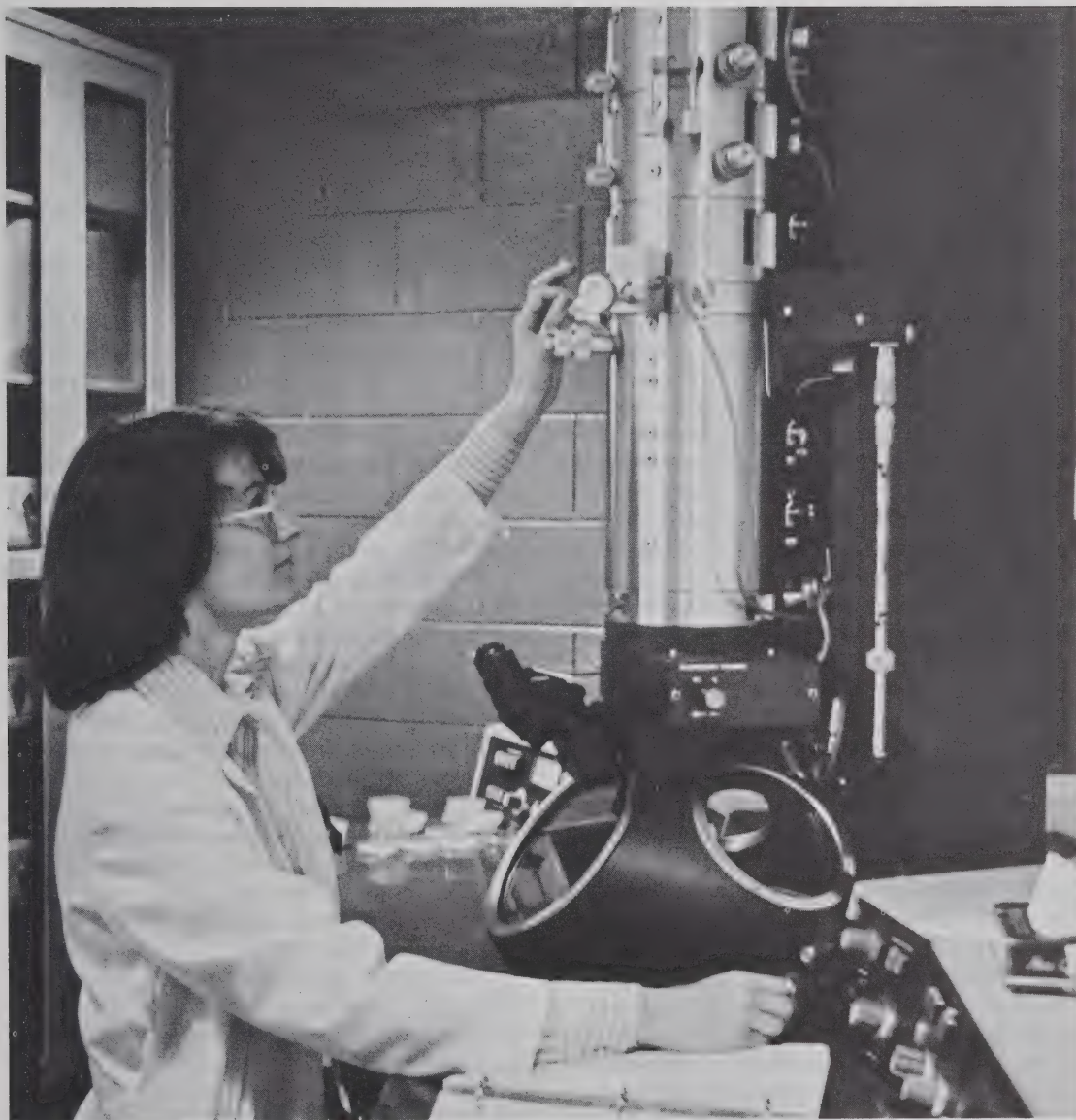
ANAT 602

Advanced Anatomy. A laboratory program of special dissections and demonstrations on selected regions of the body — thorax, abdomen, pelvis, perineum, upper and lower extremities, and the central nervous system (spinal cord and brain).

Prerequisites: ANAT 471, 472, 455, 456, 452, (NEURO 451), or equivalent.

Staff—staff. 1-3 quarter hours.

Director: Schmidt



Graduate Division of Biochemistry

Howard H. Sky-Peck, Ph.D., Director

Faculty

Bezkorovainy, A.
Booyse, F.
Cohen, M.
Cole, E.

Dubin, A.
Harrison, W.
Hayashi, J.
Hof, H.

Kachmar, J.
Kuettner, K.
Lobstein, O.
Mattenheimer, H.

Morley, C.
Rafelson, M.
Sky-Peck, H.
Weinstock, A.

Introduction

The Graduate Division of Biochemistry provides a graduate training program with excellent facilities for students pursuing work toward the doctor of philosophy degree.

The objective of this program is to provide education in and opportunity for modern biochemical research. While the orientation is not primarily clinical, location in a large active medical center provides an ideal environment for fundamental biochemical studies at all biological and medical levels.

All academic affairs for graduate students in biochemistry are directed by the graduate program director and the Graduate Advisory Committee. The director, who is nominated by the chairman of the biochemistry department and approved by the Dean and the Executive Committee of the Graduate School, is the official deputy of the Dean of the Graduate School in matters affecting graduate students in the biochemistry program. The Graduate Advisory Committee, chaired by the program director, consists of six members of professorial rank, who are active members of the graduate faculty in the biochemistry division. It approves students' advisory, thesis, and examination committees, programs of study, advises on advancement to candidacy for the Ph.D. Degree, considers petitions, leaves, readmissions, probations, etc. In general, the Graduate Advisory Committee is charged with the following:

1. To recommend to the director of the program acceptance or nonacceptance of graduate student applications for admission. In so doing, the committee considers the general admission standards set by the Graduate School and its own division standards. Following such review, the director of the program will recommend to the Dean and the Executive

Committee of the Graduate School action to be taken concerning admission of the applicant.

2. To review the progress and status of all graduate students in the program semi-annually and to notify the director and the major advisor and/or thesis advisor of any actions needed to promote the best interests of the students and/or the division.
3. To adjudicate difficulties arising between student and advisor either directly or by referring these to other committees and/or to the director.
4. To review and approve course outlines for new graduate course proposals and to submit approved new graduate courses to the Executive Committee of the Graduate School.
5. To recommend the dropping of students from the graduate program for cause.
6. To coordinate various graduate educational activities as necessary.
7. To recommend appointees to examining committees.
8. To submit to the program director informal, timely reports concerning graduate affairs in the division.

Members of the Graduate Advisory Committee are elected to serve three year terms by the active graduate faculty of the division.

It is the student's responsibility to read and observe the regulations set forth by the division, Graduate School, and Rush University. It is also the responsibility of each student to read and observe the requirements for advanced degrees set forth by the division, and to meet deadlines established herein or by the Graduate School. Failure to receive notice for examinations, filing dates, etc., does not exempt students from requirements. It is the student's duty to seek out this information.

Admission to Graduate Programs in Biochemistry

All applicants are expected to meet the requirements for admission established by the Graduate School, including a minimum grade point average (GPA) of 3.0 out of 4.0

maximum. In addition, the prerequisites described below form the basis for evaluation of applicants. On occasions, exceptions may be made to some prerequisites when outstanding creativity or potential is evident.

Prerequisites for Ph.D. Applicants

Courses: The division encourages applications from all areas of science, but expects successful applicants to have or acquire a background comparable to the requirements for the bachelor's degree in biology or chemistry. Admission with deficiencies in preparation may be granted in exceptional cases. An extensive background in chemistry, physics, or mathematics is desirable. Undergraduate training should include 24 semester hours of chemistry, including organic, quantitative analysis, and physical chemistry; 8 semester hours of physics, including laboratory work in electricity, heat, mechanics, and sound; and at least a one thorough two semester course in biology. If an applicant's undergraduate preparation is deficient, certain of these courses may be pursued without graduate credit after admission to the program. Deficiencies in these or other subjects must be made up at the earliest opportunity. Undergraduates who are prospective applicants should review their preparation for graduate school with this in mind.

Languages: No foreign language is required for admission to the Ph.D. program.

Graduate Record Examination (GRE): All applicants are required to take the Aptitude Test (Verbal and Quantitative) of the Graduate Record Examination. Although no minimum score is required for admission, most successful applicants or students obtain a total raw score of 1100 or more in these two areas. The Advanced Test in Biology is not required for admission, but applicants may find it useful in evaluating their own achievement in comparison with other applicants to graduate schools.

Letters of Recommendation: Three letters of recommendation are required. These should be from professors, supervisors, or others who may provide an evaluation of accomplishments or potential in research,

scholarly activities, teaching, and related academic functions.

Advisors: Upon admission one or more Graduate School professors will be assigned to serve as a program advisor for the applicant. The program advisor may be provisional or permanent major advisor depending upon mutual consent between the student and the faculty member. Thus applicants are urged to correspond personally with the various professors in the biochemistry program to discuss their academic interests. Applicants are also encouraged to come to the department for an interview with professors whenever possible. Every graduate student in degree status must have a program advisor (or major advisor) assigned from within the graduate program in biochemistry. This advisor, who must be an active member of the graduate faculty, has the primary duty to assist the student in planning and carrying through a program of graduate study which satisfies the program and Graduate School requirements. The major advisor serves as supervisor of the student's research project.

Where and When to Apply

Inquiries should be directed to:
Graduate School Admissions Office
600 South Paulina Street
Chicago, Illinois 60612

Inquiries are answered at any time, but applications for admission should ordinarily be completed three months prior to the anticipated date of admission to the graduate division program.

Evaluation of Completed Applications

Routing of Applications: After reviewing the application the Graduate Advisory Committee will send the application to the various subprogram directors (such as the clinical biochemistry program), or to those professors most likely to be interested in the applicant.

Evaluation by Professors: An applicant is recommended for admission or rejection by the professors. A professor recommending admission thereby agrees to serve as program advisor if assigned as such by the Graduate Advisory Committee. Once a "yes" is

obtained, a recommendation to admit the student is immediately sent by the Graduate Advisory Committee to the Graduate School executive committee for final approval. Rejected applications are returned to the appropriate Graduate School office.

Division Requirements for a Ph.D. in Biochemistry

Normal Progress: All Ph.D. students are expected to make "normal progress" toward fulfillment of the program requirements.

Failure to maintain an average G.P.A. of 3.0, failure on oral and/or written qualifying examination, or failure to complete the dissertation within four years from date of admission, result in probationary status. Students on probation may be ineligible for teaching assistantships or other financial support. Students who are teaching assistants may retain their assistantships for one additional quarter while on probation for violation of the G.P.A. requirement.

Upon recommendation of the Graduate Advisory Committee, with the approval of the graduate advisor and the student's guidance committee, the Graduate School executive committee and the dean may dismiss any probationary student who does not rectify his/her probationary status within two quarters.

Grades: Students who have an "incomplete" grade will have one quarter in which to complete the work to remove the "incomplete" grade; otherwise, the "incomplete" grade will be changed to "failure" at the end of the first quarter following receipt of the "incomplete" grade. Continuous research courses (598) are graded pass or fail and do not contribute to the G.P.A.

Program Advisor and Major Advisor: The Graduate Advisory Committee assigns a program advisor to each graduate student upon admission to the graduate biochemistry program. Assignment is by mutual consent of student and professor. The program advisor serves as chairman of the guidance committee, consisting of two other graduate faculty members, which first meets with the student during registration week to develop a program of study. Service as program advisor does not commit the professor to supervise the disser-

tation, nor does it commit the student to the professor. Changes in program advisor are made by mutual consent of concerned parties and approval of the Graduate Advisory Committee.

Normally, a program advisor serves until the student successfully completes the qualifying examinations, whereupon the student must find a major advisor within one quarter. The program advisor may also serve as major advisor to the student by mutual consent and approval of the Graduate Advisory Committee. The major advisor, who serves as research advisor and thesis advisor, is selected by the Graduate Advisory Committee for possessing appropriate professional maturity and experience in teaching, research, and other educational activities. Various factors influence student-advisor assignment: mutuality of research interests, availability or unavailability of a faculty member by virtue of his or her other obligations, anticipated compatibility of student and advisor, and student preferences. Final responsibility for the assignment of a student to an advisor rests with the program director. Neither advisor nor student may abrogate the assignment without appropriate approval.

The Guidance Committee: A guidance committee consisting of the program advisor or major advisor and two other faculty members mutually agreeable to the student will be appointed by the Graduate Advisory Committee. The guidance committee advises and guides the student until successful completion of the qualifying examinations when it is automatically disbanded. The committee meets with the student from time to time to review accomplishments and determine if normal progress has been accomplished. Lack of normal progress is reported to the Graduate Advisory Committee for appropriate action. Service on a guidance committee does not commit a member to service on the doctoral committee. However, the

guidance committee may be reconstituted as part of the doctoral committee following successful completion of the qualifying examinations.

The Doctoral Committee: Upon successful completion of the qualifying examinations, the student must obtain a major advisor to chair the doctoral committee. The committee consists of three members of the graduate biochemistry faculty who may be the program advisor and guidance committee, and two members of the active graduate faculty from outside the division and outside the student's major field or may include one member from an extramural institution with recognized excellence in graduate research and teaching in accordance with any provisions by the Graduate School executive committee. The doctoral committee is nominated by the major advisor after consulting with the student and prospective committee members, approved by the graduate advisory committee and appointed by the Graduate School executive committee. Failure to find a major advisor places a student in probationary status. The division, however, has the obligation to find research supervision for all of the doctoral students admitted to candidacy. A strong policy in this regard is that no student be "qualified" to proceed with doctoral work unless he is accepted as a thesis advisee by a member of the program.

The doctoral committee conducts the oral qualifying examination and guides the students in preparation and defense of the dissertation. After the qualifying examination has been passed and a dissertation topic approved, the doctoral committee shall also be known as the dissertation committee. The Dean of the Graduate School is *ex officio* a member of all dissertation committees. The dissertation and its defense or the final oral upon it must have the approval of at least four of the five members of the dissertation committee.

Courses, Languages, and Grades: There is no formal foreign language requirement for the Ph.D. degree; however, individual professors and/or doctoral committees may recommend to the program director proficiency

in foreign languages or other courses, and prescribe how the requirements are to be met. Each quarter in which a degree candidate student uses university facilities he must register in the appropriate graduate level course(s), or other courses recommended by the guidance committee.

1. After satisfactory completion of 48 quarter hours of graduate study and successful completion of the qualifying examinations, students are eligible to formally pursue a program toward the Ph.D. degree. Before registration of the student for work toward the degree, the doctoral committee will outline a program of formal courses, seminars, and other requirements in an integrated whole relevant to the objectives of the student and his major advisor. The program as outlined shall be recorded in the Graduate School office and may be altered at the discretion of the graduate advisory committee dependent upon the needs of the student.

A student may be granted candidacy for the Ph.D. degree only after successfully completing the qualifying examinations. The committee described above will prepare a program proposal for the Ph.D. degree with the student. This should be submitted to the Graduate School office prior to registration for the first quarter following completion of the qualifying examination, if possible, and must be submitted before registration for the second quarter after the examination.

2. Study Program — Minimum Requirements for the Ph.D. Degree

A. Formal Courses of Graduate Credit (500 and 600 Level)

In Major Discipline	36 Qtr. Hrs.
In Collateral Areas (Outside the Major)	12 Qtr. Hrs.
Research, Seminars, and Elective	96 Qtr. Hrs.
TOTALS	144 Qtr. Hrs.

- B. Pass a written qualifying examination and an oral qualifying examination.
- C. An acceptable dissertation

Students are encouraged to spend time during the summer on research or course work. All required course work and qualifying examination requirements for the Ph.D. degree should be satisfied within two and one-half academic years after admission to the program.

The Ph.D. program is established on the assumption that a well qualified student normally can complete it in four years of full-time work. If the student pursues part-time graduate study, or if the field of his graduate work is not the field of his undergraduate major, more time will be required. The student is required to complete his degree within six calendar years of the date upon which he begins graduate work in the program. Only in extraordinary cases may the time for completion be extended. A minimum of 36 quarter hours of graduate series formal biochemistry courses originally approved as such and listed as graduate series formal courses must be passed with an overall average of 3.0 by the candidate for the Ph.D. degree.

Candidates for the Ph.D. degree are required to take the following courses (or their equivalent): Bioch-501, Bioch-502, Bioch-503, Bioch-581, Bioch-595 (9 qt. hrs.), and Bioch-598 (48 qt. hrs. minimum). Students may also be required by their guidance or doctoral committee to take courses in advanced organic chemistry, physical chemistry, qualitative organic analysis, or other advanced courses relative to their academic program, which may have to be taken outside Rush University. The specific courses must be approved by the student's program or major advisor. Graduate electives may be taken within any graduate division of Rush Graduate School or at other accredited graduate institutions upon approval of the major advisor and the graduate advisory committee.

Transfer Students with Master of Science Degree: Upon the recommendation of the director of the program of biochemistry and with the approval of the Dean and the Executive Committee of the Graduate School admission with advanced standing is granted to applicants who completed a master's

degree or the equivalent elsewhere and who desire to become candidates for the doctor's degree at Rush University.

Qualifying Examination: The examination qualifying a student for candidacy for the doctor of philosophy degree is comprehensive in nature, partly written and partly oral, and designed, at least in part, to test the student's fitness to undertake independent research. Prior to taking the qualifying examination, the student must have met the division requirements of 48 quarter hours of course work and have the recommendation of his guidance committee. Students should take the qualifying examination as soon as permissible.

When the student and his guidance committee have determined that he should take the qualifying examination, the student should seek permission to take the qualifying examination from the program director no later than 60 days before the date of the examination. The examination must be taken during the quarter in which permission is granted. The qualifying examination may be scheduled by the division at any time during the quarter provided that all members of the advisory committee are available to administer it. All portions of the examination must be completed within one month. Postponement of the examination after permission has been granted must have the approval of the program director and the graduate advisory committee.

The written examination will be prepared and read by the graduate advisory committee. If the written examination is satisfactory, the student will be given an oral examination. If on the written examination the judgment of the committee is such that an oral examination cannot counterbalance a poor performance, then the committee is not obliged to give an oral examination and the report to the Graduate School will be one of failure. In the case where the written examination is marginal, the committee may use the oral examination as an opportunity to confirm or alter its judgment of the student's performance.

When the student's written examination is satisfactory, then he must be given an oral examination covering in depth topics dis-

cussed in the written examination or touching upon additional material. The fact that a student has done well on the written examination is not to be construed to mean that the oral examination is to be a *pro forma* exercise. The oral examination is a serious and integral part of the qualifying procedure. During the oral examination, all members of the doctoral committee must be present and must render a judgment on the student's qualifying examination.

In the event the qualifying examination is failed, the advisory committee, at its discretion, may permit the student to take it once more at a time mutually satisfactory and within a period of not less than six months nor more than one year from the date of the first examination. A student may not be permitted to take the qualifying examination more than twice.

A student must pass both the written and oral examinations in order to be judged to have passed the examination. The examination may not be reported as being passed if there is more than one dissenting vote.

Any student who has not been recommended for advancement to candidacy because of failure to meet these requirements, may be terminated unless he is given permission by the Graduate School executive committee upon the recommendation of the graduate advisory committee to complete a thesis and terminate his graduate work with the M.S. degree.

Doctoral Dissertation: An acceptable dissertation based on original investigation is required. The dissertation must show tech-

nical mastery of a special field, capacity for independent research, and scholarly ability. The doctoral committee guides and reviews the research and writing. Final approval in the division is accomplished when the committee approves the written form and is satisfied with the oral defense. The final public defense of the dissertation is based primarily on the graduate research and in the field of knowledge that constitutes the student's major subject. Final acceptance of the dissertation is given by the Dean of the Graduate School.

The student is expected to be registered in BIOCH 699 each quarter, excepting summer sessions, after admission to candidacy, until degree requirements are completed. Registration for the dissertation, the three quarters excluding summer session, following admission to candidacy, is the minimum requirement entitling the candidate to dissertation supervision by his doctoral committee. If the dissertation is not completed and accepted within three quarters the candidate must register for 699 each quarter thereafter until the dissertation has been accepted.

After meeting all other requirements, the candidate must defend his dissertation. This defense will be conducted in such a manner as to determine to the satisfaction of the candidate's doctoral committee whether he/she has attained the stage of scholarly advancement and power of investigation demanded by the university for final recommendation to the doctorate.



Requirements for the Ph.D. Degree in Biochemistry with a Major in Clinical Biochemistry

The purpose of the Ph.D. degree program with a major in clinical biochemistry is to improve and to extend training and research on the clinical implications and applications of biochemistry, to provide training and experience so that the biochemists can carry out effective dialogues with clinical colleagues, to provide training and experience in the operation of a hospital laboratory, and to develop an appreciation for innovative approaches to problems of laboratory diagnosis.

It is not easy to define clinical biochemistry or to describe the activities of clinical biochemists. Here the term is used to describe individuals, who are first and foremost well-grounded biochemists. Their interests are related to problems of human biochemistry and disease. They tend to be capable, analytical chemists. They have the interest in, and capacity for, continuing dialogue, teaching, and learning on the interface between basic biochemistry and clinical application.

This program has the same requirements as the regular graduate program as to entrance, electives, examinations, etc., and differs only in the electives selected. The graduate courses available for electives in biochemistry are listed below.

Graduate students admitted under this program will choose research advisors whose interests and facilities have a discernible relationship to clinical biochemistry. Electives will be selected in order to provide the best possible background for clinical biochemistry.

It should be evident that students in this program will be as competent and well-rounded biochemists as any other graduate students in the program and will not be distinguishable save for their electives and perhaps the nature of the research problem they undertake. A possible program for such students is listed below.

The Ph.D. degree is a research degree, and will be conferred in recognition of proficiency in research, breadth, and soundness of scholarship, and thorough acquaintance with a specific field of knowledge as determined by the graduate faculty.

Program of Study and Research: The education of a clinical biochemist at the doctoral level prepares him to function effectively in research, education, service, and administration. These are the responsibilities of a director of a clinical chemistry laboratory. The training includes advanced lectures, seminars, attendance at hospital rounds, experience in the scientific operation of a clinical chemistry laboratory, as well as in its management (preparation of budgets, ordering of capital equipment, purchasing, personnel relations, etc.)

The student will be exposed to intimate contact with hospital, house, and attending staffs and will participate in lectures and seminars in clinical biochemistry with the hospital staff.

Only minimal guidelines can be established for education of clinical biochemists at the doctoral level. However, to achieve the program objectives, the student should become capable of fulfilling the following functions:

Medical Function — The clinical biochemist must serve effectively as a (chemical) consultant to physicians in the area of analytical and physiological inference in reported values and in the relationship of biochemical findings to disease.

Analytical Chemical Functions — The clinical biochemist must be thoroughly grounded in theory, operation, and maintenance of all instrumentation and methodology applicable to the modern clinical chemistry laboratory.

Research Functions — The clinical biochemist must be able to conduct original research. The student must satisfactorily complete a research problem of an original nature appropriate to the analytical phase of clinical and/or a disease-related metabolic area.

Administration Functions — The clinical biochemist must function as an administrator and have a working knowledge of the ethics of medicine and science.

Educational Functions — The clinical biochemist must be able to train technologists working in his or her laboratory and those who wish to enter the field of clinical chemistry.

Exceptions and Changes to Requirements

Requests for exceptions and changes to the above requirements for any graduate student must be submitted for evaluation to the graduate advisory committee in writing, accompanied by signature of approval of the advisor and where appropriate, the committee. In general, such requests will not be

approved except when unforeseen contingencies such as illness, military service, maternity, or extenuating cases of hardship are evident.

In no case, will exceptions be granted that lower the standards in fact or intent as prescribed above or by the graduate division.

Graduate Division Faculty Research Areas

Bezkorovainy, Anatoly, Ph.D., Professor: The study of human milk and colostrum glycoproteins, the isolation and characterizations of transferrin receptor from reticulocytes, and the limit cleavage and isolation of a single iron-binding site of lactoferrin.

Booyse, Francois M., Ph.D., Associate Professor: Studies the mechanism and regulation of blood platelet interactions and platelet-vessel wall interactions in order to better understand the physiological role of platelets and vessel wall endothelial cells in maintaining normal hemostasis.

Cohen, Maynard M., M.D., Ph.D., Professor: An integrated program to study the molecular and electrical phenomena of the nervous system and subcellular structure of nerve cells to the function of the brain as a whole in health and disease is currently under investigation. These studies include the effects of new vasoactive drugs on survival of ischemic animals; the mechanism of action of catecholamines that are produced in the nervous system and function as impulse transmitters and hormones; the effects of exogenous toxins such as lead, arsenic, and mercury on cerebral biochemical systems of carbohydrate and amino acid metabolism.

Cole, Edmond R., Ph.D., Associate Professor: The fibrinolytic mechanism is a major defense system that prevents permanent occlusion of blood vessels. A plasminogen activator from tissues has been isolated in high purity to study its physico-chemical properties. Elucidation of the mechanism of

activating this process is proceeding with the objective of developing drugs to effect release.

Dublin, Alvin, M.S., Associate Professor: The study of branched-chain and aromatic amino acid metabolism in hepatic coma. The drop in concentration of branched-chain amino acids in liver leads to a series of metabolic events resulting in coma and death. Attempts are being made to elucidate the mechanism and reverse the process.

Harrison, William, Ph.D., Professor: The catecholamines function in the nervous system as nerve impulse transmitters or hormones. Hexokinase, a key enzyme in carbohydrate metabolism has been found to be stimulated by the catecholamines. The relationship of the hexokinase stimulation effect to the overall function of the catecholamines is being studied.

Hayashi, James A., Ph.D., Professor: Immunization of monkeys with extracellular extracts of *Streptococcus sanguis*-20 has resulted in a decrease in dental caries by 60% over control cariogenic monkeys. The sera from immunized monkeys exhibited an inhibitory effect on the bacterial enzyme neuraminidase. Absorption of the monkey sera with human IgM antiserum reduced the inhibitory activity significantly, whereas anti-IgG and anti-IgA had no effects.

Hof, Hildegard I., Ph.D., Assistant Professor: A study to determine the distribution of concanavalin-A binding carbohydrate chains in total brain glycoproteins is being

completed. Purification, separation, and classification of glycopeptides derived from brain glycoproteins and lactins are being studied. Demonstrated that 25% of brain glycopeptides bind lactin and concanavalin-A. Studies of 3-methoxy-4-hydroxyphenyl glycol excretion in brain dysfunction and alcoholism are being undertaken in patients.

Kachmar, John F., Ph.D., Associate Professor: A study of the gamma-Glutamyl Transferase enzyme system with emphasis on finding a more effective glutamyl-acceptor than glycine with a more soluble chromogenic substrate. There is some evidence that tissues respond to pharmaceutical agents by a rise in gamma-Glutamyl Transferase. Studies on these reactions are in progress.

Kuettner, Klaus E., Ph.D., Professor: The molecular organization and metabolism of extracellular cartilage and its relationships to cells. Studies included the changes that occur during differentiation of epiphyseal cartilage, calcification and replacement by bone, and the mechanisms that regulate bone formation and calcification. A main emphasis has been the molecular arrangement of proteoglycans, which in a very specific aggregated state show involvement in the inhibition of calcification.

Lobstein, Otto E., Ph.D., Associate Professor: Research studies into the isoenzymes and their activities of amylase, alkaline phosphatase, and lysozyme of pancreas and pancreatitis versus extrapancreatic diseases with the objective of establishing a more definitive method of differentiation.

Mattenheimer, Hermann, G.W., M.D., Professor: Twelve different enzymes have been investigated in the respiratory tract of Syrian golden hamsters following cigarette smoke inhalation. The activity of adenyl kinase is inhibited after one exposure to smoke. The inhibition of this enzyme may be a link to the ciliotoxicity of cigarette smoke. A new immunological test has been developed which permits differentiation of CPK isoenzymes. This kinetic test distinguishes between the M-subfraction of CPK-MM (Skeletal Muscle) and CPK-MB (Heart). The new test is now being evaluated in patients with myocardial infarction.

Morley, Colin G.D., Ph.D., Assistant Professor: The biochemical control of liver cell growth. This study includes the humoral and hormone factors such as insulin, growth hormone, glucagon, and thyroid hormone that appear to be capable of altering DNA synthesis in hepatocytes and may be involved in the regulation of liver cell growth. Present studies have identified a heat stable nondialyzable polypeptide(RF₁) found in serum of rats following partial hepatectomy that is specific for stimulation of DNA synthesis in hepatocytes.

Rafelson, Max E., Ph.D., Professor: The response to endothelial cells and platelets to nicotine and extracts from standardized cigarette smoke condensates is being studied. The overall goals of this program are to identify and define the effects of nicotine and standardized extracts of smoke on 1) specific growth, and biochemical and functional properties of arterial endothelial cells in culture, and 2) specific biochemical and functional properties of platelets *in vivo* and *in vitro*.

Sky-Peck, Howard H., Ph.D., Professor: Studies continue on the changes induced by various forms of chemotherapy on the incorporation of thymidine into human tumor DNA. The effects of various forms of therapy on various phases of the cell cycle are being investigated by the use of double pulse labeling. The major objective is to study the presence or absence of specific nuclear receptor activators in normal and neoplastic nuclei that regulate the synthesis of DNA. Various phases of the cell cycle are being studied for their specific functions.

Weinstock, Albert, Ph.D., Assistant Professor: The physical and chemical characteristics of heart mitochondrial creatine phosphokinase (CPK) isoenzymes is under investigation in this laboratory. The primary objective is to isolate mitochondrial CPK and study unique kinetic rates and stability characteristics applicable to the development of methodology for quantitating myocardial infarct size and for assessing therapy designed to protect ischemic myocardium.

**Sample graduate course schedule leading to a doctorate degree
in biochemistry with a major in clinical biochemistry**

First Year

Fall		Winter		Spring		Summer
BIOCH 501	5	BIOCH 502	5	BIOCH 503	5	BIOCH 598
BIOCH 595	1	BIOCH 595	1	BIOCH 595	1	Electives
CHEMISTRY*	3	CHEMISTRY*	3	CHEMISTRY*	3	
Electives	3	Electives	3	Electives	3	
12		12		12		

Second Year

BIOCH 611	4	BIOCH 612	4	BIOCH 622	2	BIOCH 598
BIOCH 613	3	BIOCH 614	3	BIOCH 690	3	Electives
BIOCH 623	2	BIOCH 621	2	BIOCH 624	3	
BIOCH 598	2	BIOCH 598	2	BIOCH 598	2	
Electives	2	Electives	2	Electives	2	
13		13		12		

Third and Fourth Year

BIOCH 690	3	BIOCH 690	3	BIOCH 690	3	BIOCH 699
BIOCH 699	8	BIOCH 699	8	BIOCH 699	8	Electives
Electives	3	Electives	3	Electives	3	
14		14		14		

This represents a generalization; in reality a graduate program will be tailored to meet the individual needs of each graduate student. Each program will be developed by the student in conjunction with his or her guidance committee and the approval of the graduate advisory committee.

*To be taken off-campus

Sample graduate course schedule leading to a doctorate degree in biochemistry

First Year

Fall		Winter		Spring		Summer
BIOCH 501	5	BIOCH 502	5	BIOCH 503	5	BIOCH 598
BIOCH 595	1	BIOCH 595	1	BIOCH 595	1	Electives
CHEMISTRY*	3	CHEMISTRY*	3	CHEMISTRY*	3	
Electives	3	Electives	3	Electives	3	
12		12		12		

Second Year

BIOCH 581	4	BIOCH 595	1	BIOCH 595	1	BIOCH 598
BIOCH 595	1	BIOCH 598	5	BIOCH 598	5	Electives
BIOCH 598	4	Electives	6	Electives	6	
Electives	3					
12		12		12		

Third and Fourth Year

BIOCH 595	1	BIOCH 595	1	BIOCH 591	1	BIOCH 699
BIOCH 699	8	BIOCH 699	8	BIOCH 699	8	Electives
Electives	3	Electives	3	Electives	3	
12		12		12		

This represents a generalization; in reality a graduate program will be tailored to meet the individual needs of each graduate student. Each program will be developed by the student in conjunction with his or her guidance committee and the approval of the graduate advisory committee.

*To be taken off-campus

Biochemistry

BIOCH 301

Basic Biochemistry. A lecture course designed as an intensive introduction to biochemistry. Emphasis on descriptive chemistry of the main classes of biochemical compounds and metabolic processes in the human organism, and changes associated with disease processes. Prerequisite: one year general chemistry, one course organic chemistry. (4-0-4)

BIOCH 401, 402

Clinical Chemistry I, II. A course on the analytical and biochemical basis of methods for chemical analysis of body fluids as related to diagnosis and treatment of disease. Topics discussed include blood sugar, carbohydrate tolerance tests, renal function tests, plasma electrolytes, blood gases, proteins, enzymes, and cholesterol. Critical evaluation of methods is emphasized. The laboratory includes experiments designed to instruct students in the quantitative analysis of clinically important metabolites. Emphasis is placed on accuracy, quality control, and fine technique. Manual methods are stressed, with a variety of methods and instruments used. The student learns to apply error theory and statistics in interpreting and evaluating results. Prerequisites: BIOCH 301. (4-0-4) (3-6-5)

BIOCH 403, 404

Clinical Chemistry III, IV. A continuation of Clinical Chemistry I, covering additional tests and topics: lipids, special proteins, chemical hematology, vitamins, biogenic amines, elementary toxicology, liver and thyroid function tests, and steroid methods. Principles underlying automated and computer application methods will be discussed. (2-0-2) (2-0-2). Prerequisite: BIOCH 401. (3-6-5)

BIOCH 461, 462, 463

Biochemistry I, II, III. A course in the chemistry and metabolism of biologically important compounds, amino acids and proteins; nucleic acids and protein synthesis; bioenergetics; biochemical function of enzymes; common pathways of metabo-

lism; carbohydrates and lipid metabolism. Additional topics include the integration of cellular metabolism; regulation of hydrogen ion concentration; reproduction on the molecular level, including genetic coding and DNA replication, transcription, and translation; nucleic acids and disease; hormones, regulation of whole body metabolism; biochemical role of vitamins; calcium and phosphate metabolism. Required for medical students. (3) (3) (3)

BIOCH 501

Advanced Biochemistry I. An advanced lecture considering enzymology, cell physiology, and the chemistry of the important classes of biological substances, including carbohydrates, lipids, amino acids, proteins, and nucleic acid. It also covers biochemical investigation, chemical thermodynamics, properties of solutions, electrode potentials, chemical kinetics, and membrane phenomena. Required of all biochemistry graduate students. (5)

BIOCH 502

Advanced Biochemistry II. An advanced lecture course considering biological oxidations, the pathways of metabolism, the control and regulation of metabolism, nutrition; and the chemical nature, biosynthesis, evolution, and mechanism of action of the hormones. Specific topics deal with the metabolism of proteins, lipids, and carbohydrates with particular attention to recent developments. Required of all graduate students. (5)

BIOCH 503

Advanced Biochemistry III. Topics include structure, physical, and chemical properties of polynucleotides and their components; physical and chemical properties and biosynthesis of nucleic acids; transfer and messenger RNA; the role of nucleic acids in protein synthesis. Other topics are the biochemical structure and function of specialized tissues, including the liver, muscle and muscle contraction mechanisms, hemopoietic system, kidney, bone, and connective tissue. Required of all graduate students. (5)

BIOCH 521

Biochemistry of Nutrition. Recent developments in the nutrition aspects of carbohydrates, protein, lipids, and trace nutritional substances will be covered. Lectures. Prerequisite: BIOCH 451 and 452. (3)

BIOCH 522

Molecular Biology. The synthesis, function, and interaction of the various macromolecular components of cells will be studied, with emphasis on the sequential residue-by-residue transfer of genetic information; also the synthesis and degradation of the extracellular structural macromolecules with emphasis upon their functions and interactions and the influence of extracellular matrices on gene expression in normal development and neoplastic states. (3)

BIOCH 523

Comparative Biochemistry. Comparative study of the metabolic strategies and biochemical structures selected by various phyla to carry fundamental biochemical functions. (2)

BIOCH 531

Neurochemistry. Study of selected topics and recent developments concerning chemical events related to brain function. (3)

BIOCH 532

Laboratory in Neurochemistry. Laboratory, conferences, and experiments concerned with brain cellular structure and membranes, enzyme activities, lipids and neurotransmitters, which will familiarize the student with techniques useful in neurochemical research such as ultracentrifugation, gas chromatography, electrophoresis, fluorimetry, and others. Prerequisite: BIOCH 531 or consent of instructor. (2)

BIOCH 581

Biological Research Techniques. Discussion and laboratory work surveying and illustrating the practical aspects of biochemical methodology and instrumentation; techniques for the isolation, analysis, and characterization of biologically important substances; the fundamental principles of radioisotope techniques, enzyme assay. Required of all biochemistry graduate students. Prerequisite: BIOCH 503. (4)

BIOCH 590

Special Topics in Biochemistry. An advanced course dealing with selected topics in biochemistry. The particular subjects vary from year to year. One to three topics are considered each time the course is given. Topics include biochemical genetics; chemistry of enzymes; phytochemistry. Prerequisite: BIOCH 503. (3)

BIOCH 595

Seminar and Journal Club. Student and faculty presentation of assigned subjects of current importance in biological chemistry and related fields. Assigned reading. Required of all biochemistry graduate students. (1)

BIOCH 598

Research in Biological Chemistry. Research on problems of biological importance with members of the graduate staff. Required for M.S. or Ph.D. degree. Variable credit.

BIOCH 602

Biochemistry of Disease. The alterations of metabolic pathways in various organs and tissue compartments are studied in relation to organ, metabolic, and genetic pathology. The biochemical derangements are illustrated with case demonstrations. Topics are selected and discussed in depth with emphasis on current research work. The facilities of the clinical chemistry laboratory are available to illustrate biochemical changes and their significance. Prerequisite: BIOCH 503. (2)

BIOCH 611

Clinical Chemistry I. Topics include basic aspects of clinical chemistry, including general laboratory procedures, collection and handling of specimens, statistics, quality control, automation, normal values; the course also includes lectures on liquid chemistry; metabolism; methodology; and the chemistry and methodology used for the identification and quantitation of biological compounds such as carbohydrates, proteins and amino acids, hemoglobin and its derivatives, porphyrins and related compounds. This includes chemical structure, physiological role, intermediary metabolism, normal values, and clinical applications. Required of clinical biochemistry majors. Prerequisite: BIOCH 503. (4)

BIOCH 612

Clinical Chemistry II. Discussions cover the clinical significance, chemistry, and assay methods of biological substances relevant to the areas of toxicology and endocrinology. Toxicology lectures cover types of toxic substances presently assayed in clinical chemistry laboratories, i.e., volatile substances, metals, and nonmetals, and nonvolatile organic substances, including various drugs. In endocrinology, lectures deal with the nature and actions of steroid and protein hormones and methods employed for identification and quantitation. Thyroid function tests are also discussed with emphasis placed on new methodology. (4)

BIOCH 613-614

Clinical Chemistry Laboratory I, II. Offered concurrently with Clinical Chemistry I and II. The qualitative and/or quantitative analysis of biological compounds of clinical interest are discussed. The graduate students rotate through the various sections of the chemistry laboratory. Instruction and guidance are provided to permit the student to perform the individual assays in order to become familiar with the techniques and instrumentation. Required of clinical biochemistry majors. (3), (3)

BIOCH 621

Laboratory Management and Supervision. This course discusses human problems in management and organization, group dynamics, decision-making, policy formulation, organization objectives, and restraints. Required of clinical biochemistry majors. (2)

BIOCH 622

Automation and Instrumentation in Clinical Chemistry. Topics include basic principles of the common laboratory instruments and the meaning of automation and mechanization in today's clinical biochemistry laboratory. Included are instruments such as spectrophotometers, pH meters, fluorometers, nephelometers, flame photometers, flow-through discrete sample, and centrifugal analyzers. Current trends in automation and instrumentation are reviewed. (2)

BIOCH 623

Science and the Law. Scientific problems encountered by the legal profession are discussed, including patents, products liability, medical malpractice, environmental law, and food and drug laws. (2)

BIOCH 624

Enzymology. Mechanisms and action of enzymes of diagnostic interest, including those associated with pancreatic function. Factors governing enzyme reactions and enzyme kinetics in relation to the assays of enzyme activities are reviewed. The chemistry, methodology, and clinical application of enzyme systems presently assayed in clinical chemistry laboratories are discussed individually. Also included are demonstrations and discussions of the instrumentation for enzyme assays. Required of clinical biochemistry majors. Prerequisite: BIOCH 503. (3)

BIOCH 690

Special Topics in Clinical Chemistry. The course will be devoted to the consideration of the more modern techniques for the determination of various constituents of physiological fluids and their significance. Topics of special interest to clinical chemists and other clinical laboratory personnel are discussed. Special emphasis is placed on recent developments in instrumentation and methodology and their clinical application. Studies based upon fundamental biochemistry and concurrent theories in the literature: the nature and variations, in health and disease, of serum proteins and serum enzymes; electrophoresis; use of enzymes as diagnostic reagents; the role of computers in clinical biochemistry; and reading assignments are presented and discussed. On occasion, experts in particular areas of clinical biochemistry are invited to conduct seminars. Graduate students are required to prepare and conduct at least one seminar session. Required of clinical biochemistry majors. Variable credit.

BIOCH 699

Thesis Research. Post-candidacy. Variable credit.



Graduate Division of Cell Biology

Brenda R. Eisenberg, Ph.D., Director

Faculty

Colgan, J. Morley, C. Eisenberg, B.	Hughes, W.	Osmand, A. Pauli, B.	Weinstein, R. Wolfe, L.
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Introduction

The faculty of the Division of Cell Biology serves the following functions in the Graduate School: it constitutes a core of common interest, providing an affiliation base for increasing activity in the area of cell biology as this area expands in the university, and it develops and presents course material in cell biology to doctoral students and to other appropriate student populations. It generates

and presents a discussion forum for the area of cell biology, utilizing intramural and extramural sources of expertise. It provides, through the ongoing research programs of its members, opportunity for advanced students to develop their own investigative talents. Through its director, the division assumes professional administrative responsibility for the electronmicroscopy laboratory of the Graduate School and its programs.

The Program

Generally, as a field of study, cell biology explores the structural organization and functional integration within cells. As a field of study, its knowledge and techniques extend to all the specialized fields of the health sciences. The purpose of this division is to supplement understanding of such basic knowledge and technique for students in the health sciences. The division encourages integration of the resources of people and facilities throughout Rush University to produce a comprehensive study of the cell. Such a purpose must be multidisciplinary, for cell biology spans many departments within Rush University, including anatomy, biochemistry, immunology, microbiology, pathology, pharmacology, and physiology.

Historically, the electron microscope has had a major impact on the growth of cell biology. The teaching of the division is centered around the electronmicroscopy laboratory of

the Graduate School. Students will study the ultrastructure of the cell and its organelles in electron micrographs. But it is most important that they learn about the function of the organelles in a multidisciplinary fashion. Thus, the supramolecular structure and biochemical ultrastructure of the cell constituents is emphasized. Advanced students will learn the technical skills necessary for pursuit of research projects involving cell biological techniques. Teaching is organized with courses in cell biology and electronmicroscopy. Students taking such courses may use them as credit toward their Ph.D. requirement in other graduate divisions of Rush University, subject only to the regulations of those divisions. As an additional activity, the division sponsors a seminar series of outside speakers instituted to foster multidisciplinary exchange and to cover material not available within Rush University itself.

Cell Biology

CEBIO 501

Cell Biology. Study of ultrastructure and function of the cell organelles; structures covered include the plasma membrane organization, cell-to-cell communication, and cell surface immunoreceptors. Also covered are the mitochondria and phosphorylation, the endoplasmic reticulum golgi apparatus and cell secretion, the cytoskeleton and molecular basis of motility, and the nucleus and cell division. (4-0-4)

CEBIO 505

Seminars in Cell Biology. Each student will give a seminar on a major research topic in cell biology. Use of library indices, review journals, and research journals will be explained. Advice will be given on preparation of teaching slides and lecture organization. Prerequisite: CEBIO 501. (3-0-3)

CEBIO 512***Scientific Basis of Electron Microscopy.***

This course provides facts about electron microscopy where possible and practical approaches where not. Techniques include the chemical basis of fixation, size and shape changes during fixation, dehydration, and embedding; plastic and frozen thin sectioning; selective staining and immunocytochemistry; autoradiography. Also discussed will be the physics of electron optics and the theory of transmission, scanning, high voltage, and x-ray detector electron microscopy. (4-0-4)

CEBIO 522

Electron Microscopy Laboratory. Practical techniques of electron microscopy are

addressed. Students dissect, fix, and imbed tissue. They will be taught the use of the ultramicrotome to stain thin sections and the use of the electron microscope. The goal of the course is the preparation of electron micrographs of research quality. Extensive time for practical use of the equipment will be available. Prerequisite: CEBIO 512. (0-8-4)

CEBIO 531

Stereology. This course will present practical and theoretical approaches in the application of measurement to anatomical structures. General principles of estimation of volume surface area and number will be covered by stereology and other techniques. (2-4-4)

Graduate Division of Immunology

Alexander P. Osmand, Ph.D., Director

Faculty

Cunningham, C.
Fiedel, B.
Gewurz, A.

Gewurz, H.
Hansen, B.

Jones, J.
Lint, T.

Luskin, A.
Osmand, A.

Program Outline

The Division of Immunology offers an interdisciplinary program of research and training in immunology leading to the degree of doctor of philosophy. The faculty of this program will be drawn predominantly from the departments of Immunology, Medicine, Microbiology, and Pathology of Rush University. Areas of current interest in which research training is offered include the immunobiology of the inflammatory response; immune interactions of cells and

membranes; the biology of the complement system, including the control of the complement attack mechanisms and the pathophysiology of complement deficiencies; cellular immunology, particularly cell-mediated mechanisms in inflammation; the immunopathology of coagulation; and the structure and function of the C-reactive proteins. The application of basic research to questions of human health and disease continues to be a general commitment of the faculty of this program.

Facilities

The participants in this program are drawn from a university faculty based in an active Medical Center dedicated both to patient care and to the support of clinical, biomedical, and

basic biological research. The contributing departments are well equipped with both teaching and laboratory facilities for research in immunology.

Objectives

The objectives of this program are to provide an environment for each student to learn to the limits of his/her ability, and to train independent investigators able both to conduct original research in immunology, and, as scientists and teachers, to effectively communicate and impart their knowledge.

The program is directed toward the Ph.D. degree. The degree will be awarded by the

university upon the satisfactory completion of the academic program and the submission and presentation of a dissertation demonstrating the ability of the student to perform and present original scientific work. In addition, the student is required to pass an oral examination based on thesis research and related areas of science, and must satisfy the examiners that a broad conceptual understanding of the field of immunology has been reached.

Application and Admission

Students who have recently received the baccalaureate, masters, or doctoral degree may apply. Although not essential, it is recommended that students wishing to enter the immunology program should have achieved a high level of competence in biology, mathematics, and chemistry. It is important that applicants be adequately prepared to engage directly in graduate study and research.

Although there is no deadline for applications, candidates for admission to the graduate program should address their inquiries not less than three months in advance of the date for which admission is sought to

Graduate Admission Office
600 South Paulina Street
Room 474M
Chicago, Illinois 60612

Applicants should send the following documents to the Graduate School Admissions Office:

1. Complete application forms from the Graduate School of the College of Health Sciences, Rush University.
2. Letters of recommendation from three or more sponsors, preferably faculty members of the student's current or recent college, who can assess the applicant's potential for independent graduate study and research. The sponsors should be made aware of the nature of the program for which entry is sought.
3. Official transcripts of all graduate and undergraduate studies undertaken by the applicant.
4. An outline of any relevant research or teaching experience.

5. A personal statement in which the applicant indicates his or her reasons for wanting to do graduate work in immunology, and describes the relevance of his or her goals and academic training to this program. An indication of the specific areas of potential research interest, when such can be identified, would be valuable in directing the applicant to specific faculty members and in advising him or her of the detailed activities and openings in that area.

Although not required, the Graduate Record Examination is strongly encouraged as an additional credential and the results of this should be submitted.

Applicants for admission to the program will be evaluated initially by the program director and the Office of the Dean of the Graduate School. Additional information may be requested prior to forwarding the application to the Admissions Committee of

the Immunology Division. Considerations by the committee will include overall academic record, the recommendations of the sponsors, and the description of the applicant's own aspirations and interests. Personal interviews may be requested of an applicant still under consideration after preliminary screening. Students will be admitted into the program at levels other than first year only under exceptional circumstances; this requires recognition by the Admissions Committee and acceptance by the Graduate School executive committee that graduate training already undertaken by the student elsewhere is of a suitable standard, and that the student has reached the required level of competence in the areas of relevance to the proposed investigation. Such students may be exempt from certain coursework and/or preliminary examinations. However, credit for research hours will not be allowed.

Program Leading to the Ph.D. Degree

A minimum of three years and a maximum of five years full-time (four quarters per year) study and research, or equivalent in part-time study, is required to satisfy the residency requirements of this program. Although there is no prescribed sequence of courses, students are expected to study and learn to the limits of their ability and achieve an understanding of the four major areas of immunology: immunobiology, immunochemistry, immunogenetics, and immunopathology. Additional training is available to allow the students to develop a competence in clinical laboratory immunology.

During the first 12 to 18 months the student will carry out an academic program designed for his or her own requirements, through frequent and continuous discussion with the Graduate Advisory Committee of the immunology division or the student's thesis committee, that should provide the student with a thorough grounding in immunology and

extensive practical experience in several laboratories of the division faculty. The selection of a principal advisor should be made between 6 and 12 months after admission. With the exception of prescribed seminars and tutorial courses, students will devote themselves full-time to thesis research following successful completion of courses and acceptance of the proposal within 18 months of entering the program. The research program will be carried out under the guidance of a designated principal advisor and a thesis committee. Following agreement by the student, advisor, and thesis committee that a suitable stage in the research program has been reached, the student will prepare and present a dissertation demonstrating the ability to carry out a research program and perform an original contribution in the area of investigation. An additional examination of the student's understanding within the field of immunology will also be made.

Course Requirements

Although there are no formal course requirements, independent study from prescribed reading lists and frequent discussion with faculty will be supplemented with lecture-tutorial courses of both a basic and advanced nature within the Division of Immunology. Other course requirements, as specified in the student's academic program, may be met by completion of lecture, tutorial, or laboratory courses in other divisions of the Graduate School. Successful progress will be assessed by the instructors of such courses. It is anticipated that courses in some subjects considered essential for a particular student's academic program will not be available in the Graduate School. Such requirements may be met either by special arrangement with the

faculty of other institutions, or by enrolling in or auditing such courses available at other institutions within the geographical area. Faculty assistance in the identification of these courses and supporting tutorial instruction will be arranged by the program director; in addition, performance may be assessed in the same manner as intramural courses.

In addition, students admitted to this program will be encouraged to attend lectures presented in the immunology courses for Rush Medical College. Involvement is required in the Department of Immunology research conferences, journal clubs and tutorial discussions, as may be specified from time to time by the Graduate Advisory Committee.

Assessment of Progress

The academic progress of each student will be continuously assessed by each faculty member with whom the student has worked. The use of conventional examinations or tests is not encouraged, although instructors are free to use whichever system of assessment they wish to apply.

The overall progress of a student is evaluated annually based on written reports from faculty members and a report from the student. The report should describe the status of the academic program and the progress of research and laboratory activities, and should identify projected requirements for the remainder of the program. Students will be graded in accordance with the regulations of the Graduate School, although, in addition to a transcript, a statement of progress may be

compiled from the student and faculty reports and this will be submitted together with grades to demonstrate the student's successful progress.

It should be stressed that the purpose of such assessment and examination is primarily to aid the student in achieving academic goals by determining depth of understanding of the several areas of study, and, when necessary, identifying problems in order to enlist the aid of other faculty to assist the student in his or her training. Considerable importance in this continuous assessment is placed on the student's ability to communicate. Guided development of the skills required for both literary and verbal presentation of knowledge and ideas, as well as their formulation, is an important responsibility of the faculty in this program.

Graduate Advisory Committee

A committee consisting of at least three and preferably five faculty members, including the program director of the Division of Immunology, shall meet regularly with each student during the first 4 to 6 quarters of residence. Initially the role of this committee is to assist the student in the design of an appropri-

ate academic program; secondarily to ensure the continued satisfactory progress of the student and initiate any necessary changes or additions of this program; and finally to guide both the student and faculty in the selection of advisors and in the appointment of the thesis committee.

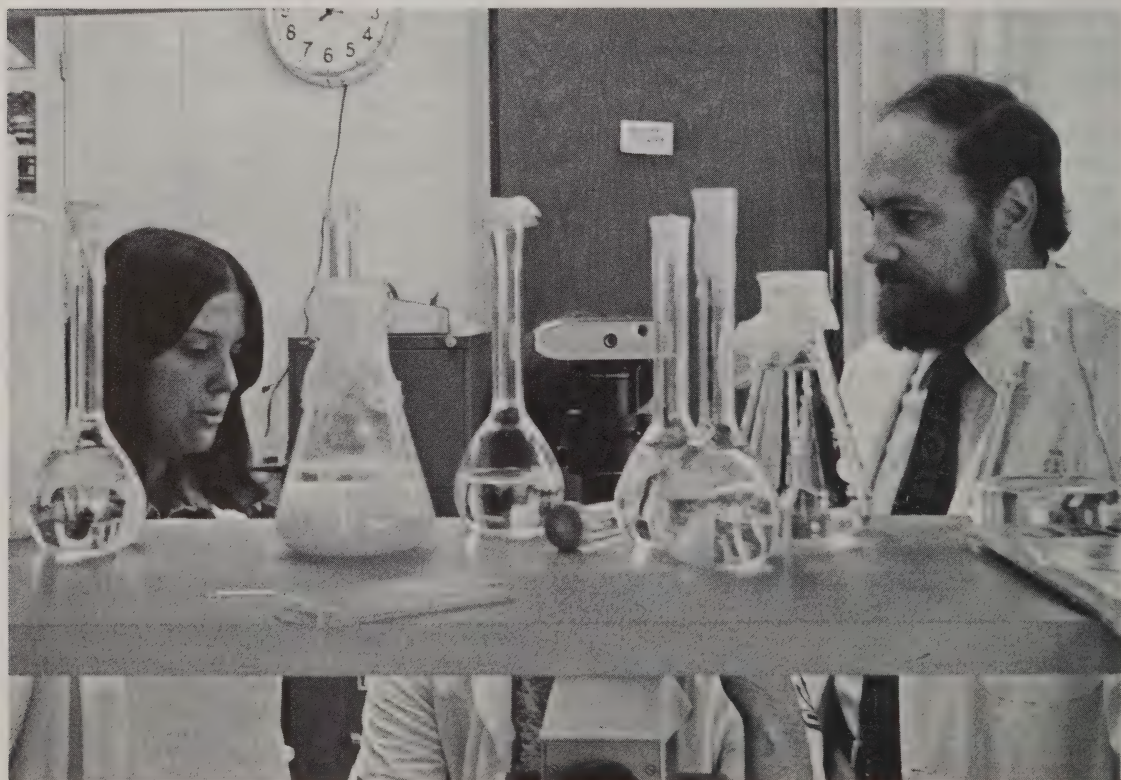
Thesis Committee and Thesis Proposal

It is expected that within 12 months of admission the student shall have identified an area of specialization and a principal advisor with whom to carry out his or her research activities. Prior to proceeding with the research program and within 18 months of admission the following requirements must be met and accepted by the Graduate Advisory Committee:

1. Successful completion of course work identified in the student's academic program;
2. Adequate performance in an oral and/or written preliminary examination;
3. Formation of a thesis committee that shall have at least three and preferably five members: the principal advisor, the program director, and one other individual with recognized expertise in the candidate's field of interest, who is selected jointly by the candidate, principal advisor and program director. This individual should be a faculty member of

an institute of higher education, active in research in the area of investigation and should demonstrate willingness to maintain active contact with, and advise, the committee and student concerning the progress of research training for the duration of the candidacy. When additional advisors are required, these also shall be members of the thesis committee.

4. Acceptance by the thesis committee of a thesis proposal for the research program that should constitute a scholarly outline of work leading to a contribution to existing knowledge. The proposal should include an extensive review of the relevant literature, and a detailed outline of the proposed research demonstrating an understanding of the technical and theoretical aspects of the experimental protocols. The student may be required to defend this proposal before the Graduate Advisory Committee.



Thesis

Following admission to candidacy the students shall devote themselves full-time to research activities under the guidance of the principal advisor and thesis committee, and shall be actively involved in all the scholarly pursuits of the division, including tutorials, seminars, and journal clubs. Students are expected to seek out opportunities to gain experience in teaching and, where possible, to be maximally involved in the teaching activities of the division faculty, to the extent that this does not interfere with the progress of the research program.

Following at least six quarters of research activity and agreement by the student and thesis committee that research progress is such that a dissertation may be prepared and presented, the Graduate Advisory Committee shall be notified. At least six months prior to the expected date of completion, a timetable will be set by the Graduate Advisory Committee (with the approval of the thesis committee) providing a deadline for submission of the thesis and times for presentation and defense of thesis. Additional examinations also may be required and a timetable will be established for these.

A thesis examination committee will be appointed for each candidate by the Graduate Advisory Committee with the approval of the Graduate School Executive Committee and the dean. The committee shall be composed of the thesis committee of the student and two or more members of the faculty of the Graduate School, one of whom should be familiar with the area of investigation of the thesis. In addition to their evaluation of the thesis the examining committee will request evaluation of the written dissertation by at least one scientist (external examiner) of

international stature in the field of investigation who is not affiliated with Rush University.

Recommendation to the university for the award of the degree of doctor of philosophy is made on the basis of scholarly achievement and research ability. The role of the thesis examination committee is to evaluate the student based on the following:

1. Annual progress reports by both student and faculty;
2. Presentation of the scientific basis of the dissertation in an open lecture;
3. Reports of the external examiner(s) concerning the standard of scholarly research presented in the dissertation;
4. An oral defense of thesis before the students and faculty of the division; and
5. Successful performance in oral and/or written examinations to determine the student's overall competence in the field of immunology.

The thesis examination committee may request additional examination of the student or evaluation of the dissertation. Upon agreement that the student has satisfactorily met the requirements for the award of the degree, the recommendations of the thesis examination committee will be forwarded to the Graduate Advisory Committee for communication to the Graduate School.

If within 10 quarters of research activity the student has not submitted a dissertation or the thesis committee has failed to notify an intent to submit a dissertation, the Graduate Advisory Committee may assume the role of thesis committee to evaluate the progress of the student and suggest alterations that would enable candidacy requirements to be completed within one calendar year.

Course Offerings

A. The following courses will be available, subject to demand and to limitation, to first year graduate students within the Graduate School. Prerequisites are a general competence in chemistry and biology. Variable credit.

IMMUN 501

Fundamentals of Immunology: An introductory course including lectures and tutorials, an historical background in immunology, the structure and development of the lymphoid system, antigen-antibody interactions, and the biology of lymphocytes.

Prerequisites: instructor approval
Staff—fall quarter

IMMUN 502

Basic Immunochemistry: Topics include structure of immunoglobulins, hapten-antibody reactions, the antibody combining site; complement; and antibody heterogeneity.

Prerequisites: instructor approval
Staff—fall quarter

IMMUN 504

Biology of the Lymphocyte Membrane: Study of structure and composition of cell membranes, fluid-mosaic model, properties of the cytoskeleton, receptor redistribution, antigen receptors and cell recognition, and histocompatibility antigens.

Prerequisites: IMMUN 502 or equivalent
Staff—fall quarter

IMMUN 505

Complement: Topics include components of the classical pathway, alternate pathways, lysis of cell membranes, complement deficiencies, genetics of the complement system, regulation, and control.

Prerequisites: Immunology 502 or equivalent, instructor approval
Staff—winter quarter

IMMUN 506

Phagocytosis and Host-Parasite Relationships: Topics include mononuclear phagocytes, polymorphonuclear leukocytes, the nature of lysosomes, mechanisms of chemotaxis, phagocytosis and intracellular digestion, metabolic pathways in phagocytes, role of the phagocyte in disease.

Prerequisites: instructor approval
Staff—winter quarter

IMMUN 507

Ontogeny and Phylogeny of Immunity: Topics include phylogeny of the lymphoid system, evolution of the immunoglobulins, immune mechanisms in invertebrates, and ontogeny of the lymphoid system.

Prerequisites: Immunology 501, 502;
instructor approval
Staff—spring quarter

IMMUN 508

Introduction to Immunogenetics: Study of allotypes, blood group substances, histocompatibility antigens, immune

response genes, the major histocompatibility complex, genetics of the H-2 and HLA systems.

Prerequisites: Immunology 501, 504;
instructor approval
Staff—spring quarter

IMMUN 509

Tumor and Transplantation Immunology: A tutorial course, supplemented by extensive reading lists, introducing the immunology of malignancy and tumor biology, allograft rejection and graft vs. host reactions, immune surveillance and alloaggression.

Prerequisites: Immunology 501, 508 or equivalent; instructor approval

Staff—summer quarter

IMMUN 511

Hypersensitivity and Immunological Mediators. A tutorial course describing the biochemical and cellular mechanisms of hypersensitivity reactions.

Prerequisites: Immunology 501, 508 or equivalent; instructor approval

Staff—summer quarter

B. The following courses are specified as requirements in the Immunology program and run continuously through the specified year. Variable credit.

IMMUN 581

Immunological Research, Techniques, and Instrumentation. A program of laboratory experience for first year students in several faculty laboratories, complemented by lecture/discussion groups on theoretical aspects of laboratory methods. An introduction to the physical biochemistry of macromolecules; preparation of antigens and antibodies and their detection; chromatography, electrophoresis, analytical and preparative ultracentrifugation; spectrophotometry and fluorimetry; light, fluorescence and electron microscopy; tissue culture methods; detection, and enumeration of lymphocytes and antibody-forming cells. Demonstration of research instrumentation facilities. First year students.

IMMUN 590, 690

General Topics. Tutorial programs supplemented by general reading lists and paper presentation designed to maintain and develop a general understanding of immunology.

Program director/Chairman, Department of Immunology; by rotation.

IMMUN 592, 692

Advanced Topics in Immunology. Tutorial programs supplemented by general reading lists, paper presentations and essays concerning the areas of immunology specified by the instructor. This program is aimed at involving students in the specialties of the various faculty members and at developing literary and critical skills in the expression and interpretation of scientific information.

Staff—by rotation

IMMUN 699*Thesis Research*

C. Optional and advanced courses, subject both to demand and limitation, may be available during the first and second year, mainly tutorial. Variable credit.

IMMUN 514, 614

Clinical Laboratory Immunology. A two-year program of practical and theoretical experience in all aspects of clinical laboratory immunology and immunodiagnosis.

IMMUN 621

Cellular Immunology and Immunogenetics. Advanced tutorial—Variable credit.

Staff—fall and winter quarters, second year students.

IMMUN 622*Medical Immunology:*

Advanced tutorial. Variable credit.

Staff—fall and winter quarters, second year students

IMMUN 623*Immunopathology:*

Advanced tutorial. Variable credit.

Staff—fall and winter quarters, second year students

D. The following courses, given by the Department of Microbiology in the College of Health Sciences, are designed for graduate students, and may be selected for a student's academic program in addition to courses offered by other divisions of the Graduate School.

MICRO 501

Clinical Microbiology: Specimen collection, organism isolation and identification, and interpretation of serology are studied. Infections of various organ systems are covered as a lecture-seminar series and by assignment of pertinent readings.

Staff—alternate years, by arrangement. 3 quarter hours.

MICRO 502

Viral Oncology: This course offers a comprehensive review of biologic, immunologic, and molecular properties of animal putative human oncogenic viruses. Techniques employed for investigating the role of viruses in neoplasia are reviewed.

Staff—alternate years, by arrangement. 3 quarter hours.

MICRO 503

Animal Models of Human Diseases: Natural and experimental diseases of animals are compared with similar diseases in man. Models of selected infectious, immunological, degenerative, metabolic, and neoplastic diseases are presented as a lecture-seminar series with bibliographies provided for each model system.

Staff—alternate years, by arrangement. 2 quarter hours



Graduate Division of Pharmacology

Arthur V. Prancan, Ph.D., Director

Faculty

Carson, P.	Frischer, H.	Moon, B.	Prancan, A.
Ebersman, D.	Klawans, H.	Parkhurst, G.	Trenholme, G.
Ecanow, B.	MacLeod, C.		

Introduction

The Division of Pharmacology offers study and research programs leading to the degree of doctor of philosophy. The division is composed of faculty members active in basic medical research, pharmaceutical sciences, and clinical investigation. Such diversity of interest allows this division to design doctoral programs which can satisfy the needs and desires of students interested in most aspects of pharmacology. The goal of this division is to provide excellent research opportunities for these students. Each student will have the opportunity to participate in research of the most basic chemical nature and in research aimed at solving disease problems. Emphasis will also be placed on the development of drug analysis methods both for research and as a practical laboratory problem in a service setting, especially as related to drug trials and other areas of clinical investigation.

Research experience is being offered in the following general areas: drug effects on cellular metabolism, drug metabolism, phar-

macogenetics, cardiovascular pharmacology, biochemical pharmacology, neuropharmacology, and clinical pharmacology. Current research projects which may be available to graduate students in the Division of Pharmacology include: mechanism of action of various redox drugs as investigated by studies of red cell metabolism; hereditary and acquired disorders of the pentose phosphate pathway, glycolysis, and hemoglobin; parkinsonism and related disorders; clinical drug testing (Phase I and II); analgesic properties of physostigmine in relation to the morphine receptor theory; pharmacology of propranolol; clinical pharmacology of methotrexate; prostaglandin metabolism in endotoxin shock; corticosteroids and carbohydrate metabolism in endotoxin shock; detection of circulating bacterial antigens; and clinical pharmacology of new antibiotics.

Students who wish to participate in this program ordinarily will have received at least a baccalaureate degree from an accredited American college or an equivalent degree from a foreign institution.

Admission

In addition to the basic requirements established by the Graduate School, The Division of Pharmacology has the following requirements for admission to its program. The academic experience of the student will usually include an undergraduate grade point average of 3.0 overall (four point scale), with a 3.5 average in science courses. Recommended courses include calculus, college physics, organic chemistry, and physical chemistry. Students with deficiencies in basic course work can be admitted to the program. However, for any such applicant, the division will retain the right to require extra course work which will then be considered a prerequisite for admission to candidacy for the Ph.D. degree.

The Graduate Record Examination is not required by the division, although it is highly recommended that applicants take the verbal, the quantitative and the appropriate advanced tests. Further information regarding the GRE may be obtained by writing the Educational Testing Service, Box 995, Princeton, New Jersey 08540. The scores should be directed to the Division of Pharmacology.

Applications for admission will be accepted by the division for all quarters of the year. Incoming students with undergraduate experience, but no graduate training, should consider applying only for the fall quarter, due to the scheduling of the basic required course sequence. Students with research experience can begin graduate studies during any quarter of the year, and such applicants should expect

to continue their research or begin an active research program within the division at the time of their admission. In either case, early application is recommended because of the small number of places available. The applications for a given admission date will generally be evaluated three months before that time.

Applications will be evaluated by the Pharmacology Division director and by the division admissions committee. The admissions committee will base its recommendation regarding admission of the applicant on several factors. All prior academic experience and the letters of recommendation will be evaluated for an indication of the applicant's potential for success in graduate studies. The statement by the applicant,

which describes his own goals and motivation, will be studied to determine the compatibility between the applicant's goals and the capabilities of the graduate program. With rare exceptions, all applicants will be required to appear for an interview with faculty members in the Division of Pharmacology before admission to the program. A recommendation from the division regarding the applicant's admission will be presented to the dean and the graduate school executive committee for final approval. Inquiries, other than requests for application materials, should be addressed to the Graduate Program Director, Division of Pharmacology, College of Health Sciences, Rush University, 1753 West Congress Parkway, Chicago, Illinois 60612.

Ph.D. Degree Program

Outline. This program is based on a study and research schedule that should be completed within three to six years of full time study. The minimal residence requirement established by the Graduate School is two years of full time enrollment. During the first year the student will usually be committed to completing required course work and deficiencies, if any. Elective courses in other divisions will be available throughout the program. During the second and later years, required courses will be completed and the student will be encouraged to enroll in appropriate advanced courses within this and other divisions of the Graduate School. Research will ordinarily begin during the first year and will continue as the primary activity throughout the second and later years.

Required Courses. The required courses for all graduate students in pharmacology will be advanced biochemistry, medical physiology, biostatistics, medical pharmacology, pharmacokinetics, laboratory instrumentation, and seminar. The specific course numbers are:

BIOCH 501
BIOCH 502
BIOCH 503
PHYSO 451
PHYSO 452
PRMED 531

PRMED 532
PRMED 533
PHARM 501
PHARM 502
PHARM 503
PHARM 521
PHARM 531
PHARM 691

For students who have already taken these courses elsewhere, the recommendation of the present course director and evidence of satisfactory performance in the course, may allow the division to consider the requirement satisfied.

Academic Advisor, Major Advisor. The graduate program director will function as the academic advisor to the student during the first year. The director will, during this time, determine the course schedule with the student and monitor the student's progress. Beginning in the first year, the student will be expected to gain laboratory experience. This activity is intended to lead to the definition of research interests and to the selection of a major advisor. The major advisor, a faculty member in the Division of Pharmacology, will then accept the supervisory role in the development of the student as a scientific investigator.

Advisory Committee. Once a major advisor is chosen, this person and the student will assemble an advisory committee. The com-

mittee will consist of five Graduate School faculty members, no more than four to be from the Division of Pharmacology, including the major advisor, who will serve as chairman. This committee will be responsible for adapting continued course work to the student's needs and for providing advice and evaluation at all points in the graduate education experience. Specifically, the committee will evaluate the dissertation protocol, the dissertation and performance at the dissertation defense.

Comprehensive Qualifying Examination. Toward the end of the second year the student usually will be expected to take the comprehensive qualifying examination. This examination can only be given with the recommendation of the advisory committee after elimination of all deficiencies and completion of all required courses. The examination is designed to test general knowledge in pharmacology and it will be administered by the Division of Pharmacology faculty. The level of performance on this examination will determine if the student is admitted to candidacy for the Ph.D. degree. Students who are unsuccessful in gaining admission to candidacy for the Ph.D. degree may retest one time only, six to twelve months after the original examination date.

Dissertation Research. Before the specific dissertation research is begun, a detailed dis-

sertation protocol, including a literature review, must be presented to the advisory committee. At this time the student will be required to orally defend the research proposal by demonstrating an understanding of its goals and of the methods used to achieve those goals. When the committee is satisfied that these qualifications have been met, it will recommend that the student begin the research project. Although the research will be closely supervised by the major advisor, the student will be expected to accept the responsibility for attainment of the research goals.

Once the research is complete, the student will present a reading copy of the dissertation to the advisory committee for its evaluation and comments. The committee will be responsible for offering suggestions to the student on how the work may best be presented in a dissertation. Following this advice, the student will complete the dissertation and will make a formal presentation of it to the advisory committee as the dissertation defense.

The awarding of the Ph.D. degree will indicate the demonstration of a capability for independent research and represent a contribution to scientific knowledge, as judged by the advisory committee, the division faculty, the dean, and the executive committee.

Pharmacology

PHARM 501

Medical Pharmacology. General aspects of the physiochemical factors governing drug-receptor interactions, absorption, distribution, biotransformation, and excretion of drugs are considered as well as drugs affecting the autonomic nervous system. Fall (60 hours).

PHARM 502

Medical Pharmacology. Continuation of PHARM 501. Virtually all important classes of therapeutically useful agents are considered. Winter (60 hours).

PHARM 503

Advanced Medical Pharmacology. A study of the mechanisms of action of special classes of drugs. Emphasis is placed on the pharmacophoric moiety and the relationship of the chemical structure to the biological activity. Prerequisite: PHARM 502. Spring (4-0-4).

PHARM 521

Laboratory Instrumentation. Course covers principles and applications of experimental equipment. Techniques that make use of such equipment include: ultraviolet and visible spectrophotometry, spectrophotofluorometry, thin-layer chromatography, column chromatography, high pressure liquid chromatography, gas chromatography, mass spectrometry, atomic absorption, liquid scintillation spectrometry, platelet aggregation, oxygen measurement, blood pressure and flow measurements, cardiac tension measurement, tissue oxidation, isotope use and handling, pH adjustment, sample weighing, melting point determination, hematocrit determination, centrifugation, and glassware cleaning. (0-6-3).

PHARM 531

Pharmacokinetics. A course on advanced aspects of drug absorption, distribution, and elimination. (3-0-3).

PHARM 541

Research in Blood Genetics and Pharmacogenetics. Credit variable.

PHARM 598

Research in Pharmacology. Credit variable.

PHARM 603

Biochemical Pharmacology. Topics include biochemical aspects of pharmacokinetics, structure-function, drug-receptor interactions, and comparative pharmacology. (3-0-3).

PHARM 604

Neuropharmacology. Seminar course presenting both preclinical and clinical aspects of drugs used in the treatment of neurologic and psychiatric disorders. Prerequisite: PHARM 502. Fall, winter, spring. Offered in alternating years. (2-0-2).

PHARM 605

Animal models in neuropharmacology. Seminar. Prerequisite: PHARM 604. (2-0-2).

PHARM 621

Cardiovascular-Renal Pharmacology. Course in advanced concepts of drug action as they relate to hypotension, hypertension, and altered flow states. (3-0-3).

PHARM 622

Cardiovascular Experimental Methods. A laboratory course concerned with the techniques involved in preparing experimental cardiovascular animal models. (0-4-4).

PHARM 631

Clinical Pharmacology and Therapeutics. Study of integration of clinical work with therapeutic aspects of pharmacology; includes discussion of the pharmacology, clinical pharmacology, therapeutics, and clinical applications for major drug groups. Prerequisite: PHARM 502. (4-0-4).

PHARM 641

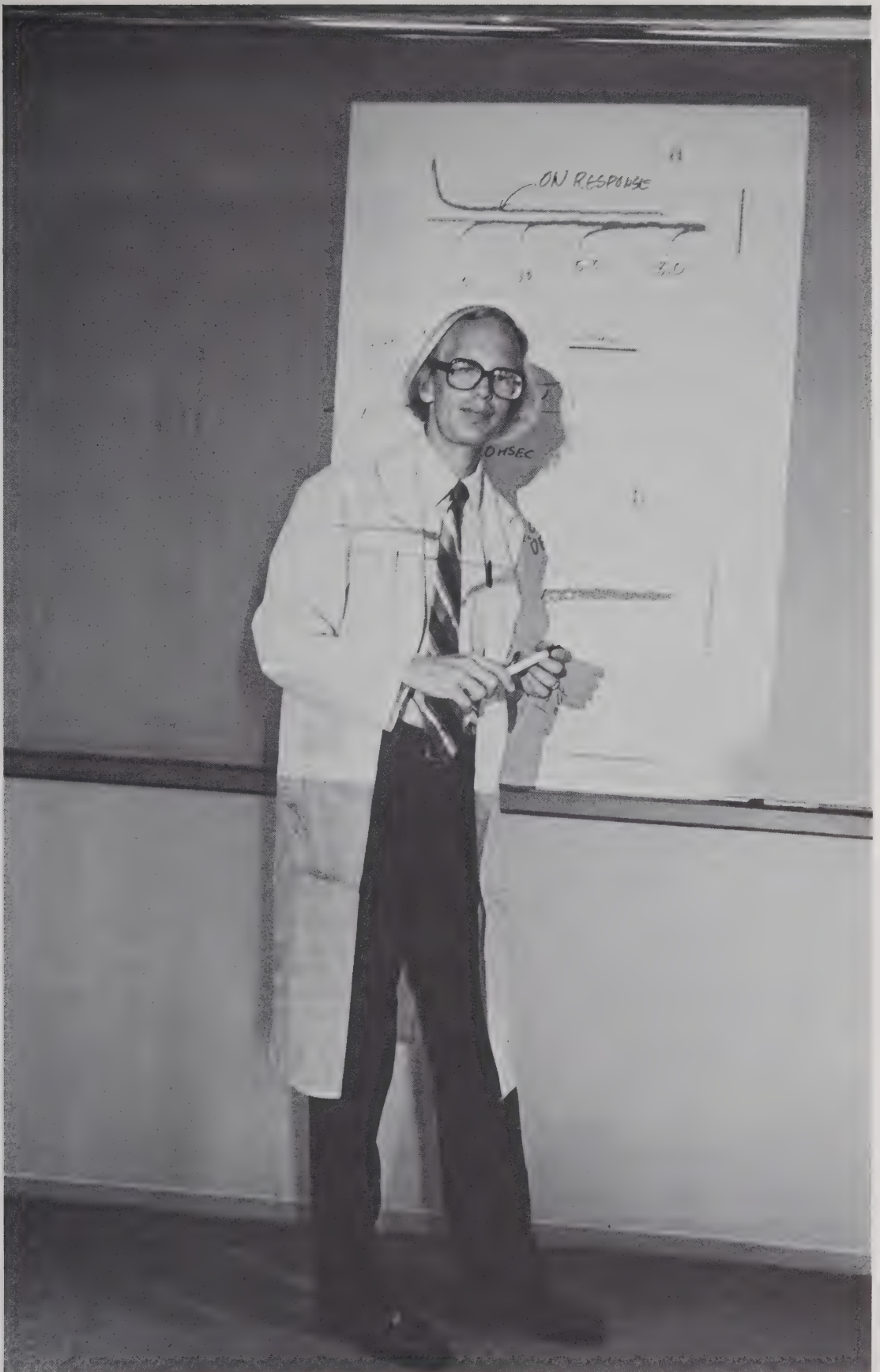
Pharmacogenetics. Advanced tutorial covering current concepts in genetic influences on pharmacodynamics. (3-0-3).

PHARM 691

Pharmacology Seminar. (1).

PHARM 699

Dissertation Research. Credit variable.



Graduate Division of Physiology

Charles L. Schauf, Ph.D., Director

Faculty

Eisenberg, B.
Eisenberg, R.
Gottlieb, G.

Hegyvary, C.
Heyer, C.
Levett, J.

Lewis, C.
Mathias, R.
Michael, J.

Pencek, T.
Rovick, A.
Schauf, C.

Introduction

The Graduate Division of Physiology of Rush University offers a program of largely independent study and research leading to the degree of doctor of philosophy. Advanced research training is offered in the fields of membrane structure and function; electrical properties of cells and tissues, including both peripheral nerve and muscle; synaptic physiology; neurophysiology, including aspects of visual processing and human motor control; cardiovascular physiology, including cerebrovascular control; and active transport processes. More detailed descriptions of the research activities of the division may be requested from the division director.

Students who desire to specialize in this program are strongly advised to obtain a broad scientific foundation, including work in the related sciences. Courses in some or all of the following fields are suggested for attainment of this objective: physics, including electronics; chemistry, including physical chemistry; mathematics, including differential equations; molecular and cell biology.

Candidates for admission to the graduate program should address their inquiries at least three months in advance of the date for which admission is sought to:

Graduate Admissions Office
600 South Paulina Street
Room 474M
Chicago, Illinois 60612

An applicant who holds a degree from an accredited institution will be considered for admission on the basis of (1) an undergraduate record of superior quality demonstrating proficiency in quantitative science, (2) a well-organized plan for graduate study and research compatible with expertise in the division, (3) recommendations from at least three college faculty members acquainted with the character and ability of the applicant to function in a program stressing an independent approach to the acquisition of knowledge, and (4) other materials as may be required by the program director. The Graduate Record Examination is recommended, but is not required. Except in unusual cases, the minimum prerequisites for admission will be the attainment by the applicant of a 3.0 overall average (4 point scale) in undergraduate studies with a 3.5 average in science courses preferably including the following: two years of physics or engineering; inorganic and organic chemistry; physical chemistry; advanced calculus; ordinary differential equations; cell biology or cell physiology.

The Program Admission

Applicants for admission to the division will be initially evaluated by the director and advisory committee. Considerations will include overall academic record, evidence of previous ability to pursue successfully independent studies, recommendations of the applicant's undergraduate faculty, and the description of the applicant's scientific research interests. The program director also will determine whether additional supporting evidence would aid evaluation of the applica-

tion and, if so, make appropriate arrangements with the applicant.

Applications judged by the program director to demonstrate satisfactory credentials and interests compatible with the research facilities of the faculty will then be evaluated by all faculty members with expertise in the area(s) of interest of the applicant. Considerations in this phase will include not only academic ability, but also the resources available to support research in the indicated area. An interview may be requested. Ultimately, selection of applicants will be by invitation of

a faculty member in the division willing and able to serve as the student's principal advisor and research sponsor, after endorsement of the selection by the program director, Executive Committee of the Graduate School, and the dean. In special circumstances, exceptions to this procedure may be made for students with unusual promise, but with no firm

commitment to a particular area of research. In such case, the program director will serve as interim principal advisor. Finally, in the case that the program director would be the principal advisor of a student, the physiology department chairperson shall assume the duties of program director with respect to that student.

Course Requirements

All students admitted to the division will be required to enroll in the medical physiology course as soon as practicable after admission. The course will be supplemented in certain areas by an extensive outside reading list and/or special tutorial study with the faculty. In addition, each incoming student will also be expected in the first year to enroll in the following courses, each involving tutorial study with one or more members of the faculty:

- | | |
|-----------|----------------------------------|
| PHYSO 502 | Introductory Membrane Biophysics |
| PHYSO 503 | Physiology of Striated Muscle |
| PHYSO 513 | Cardiovascular Physiology |
| PHYSO 514 | Functional Neurophysiology |

Other course requirements will be met by tutorial programs with faculty in the division, by courses in other divisions of the Graduate School, or by special arrangements with other institutions. The student and his principal advisor (in consultation with the program director) will choose elective courses based in part on the student's previous formal training in subjects deemed essential to work in his area of interest. Most students will be required to select a minimum of three additional courses from among those described in the course offerings of the Division of Physiology, but this requirement may be increased at the discretion of the principal advisor and program director.

It is anticipated that, occasionally, courses deemed essential to the student's graduate training by the division will not be available in the division of physiology or other divisions

of the Graduate School. In this case, arrangements will be made for the student to enroll in such courses at neighboring institutions and performance in these courses will be required to be at the same level as for courses at Rush. In certain circumstances, a program of supervised independent study may be recommended as an alternative to particular course work.

Each student shall be required to pass a comprehensive preliminary examination which will insure a minimum necessary level of familiarity with all areas of modern physiological research. This examination will be arranged by the student and program director no later than 18 months after admission to the division.

Exceptions to the foregoing course requirements may be made by the program director in some instances for students entering the program with a post-baccalaureate degree and/or evidence of previous successful completion at other institutions of courses judged to be comparable to divisional required courses. Individual course requirements may be exempted on the basis of a past academic record, by the successful completion of a special examination covering the content of the required course, or in unusual circumstances by the successful completion of the preliminary examination itself. Such exemptions will not be made automatically solely on the basis of a past academic history but will be carefully judged on an individual basis by the program director and advisory committee. Recommendations for exceptions made by the program director must have the approval of the dean.

Thesis Proposal

Upon admission to the division, the student and his/her principal advisor shall begin to make preparations for a proposal upon which the student's original research project will be based. Such preparations will include intensive study of the literature in the student's field of interest, instruction in the basic laboratory skills necessary for professional development in the field, and any other requirements established by the principal advisor and program director, in addition to the course requirements discussed above.

No later than eighteen months after admission, the candidate shall present to his/her thesis committee an original proposal for contribution to knowledge in his/her area of specialization. It shall include an extensive review of the relevant scientific literature, a description of the technical aspects of the proposed studies, an outline of the anticipated experimental approach to the major problem of interest, and a discussion of possible results and their interpretation. The student will be expected to defend both his/her proposal and general ability to achieve pro-

fessional competence before this committee.

The thesis committee shall have at least three members: the principal advisor; the program director; and, whenever possible, an individual outside the institution with national stature in the candidate's field of interest selected jointly by the candidate, principal advisor, and program director. In addition to evaluating the content of the thesis proposal, the outside member shall have a responsibility to maintain close and frequent contact with the student and principal advisor and to advise the program director concerning the progress of the academic program. Ordinarily, the thesis committee shall be constituted as soon as practicable after admission of a student to the division.

Note that the thesis proposal may be submitted to the faculty prior to completion of course requirements or the preliminary examination in order to enable research activity to begin, but the student will not be formally admitted to candidacy until these are satisfactorily completed.

Candidacy

Upon successful completion of the preliminary examination and acceptance of the thesis proposal, the student shall be admitted to candidacy for the Ph.D. and shall be expected to devote fully his/her energies to the program. A minimum residency requirement of one calendar year following admission to candidacy must be met by all students unless special exceptions are granted by the program director and dean. The principal advisor shall make frequent reports to the program director concerning the student's progress, and should either faculty member or the candidate feel it appropriate, the thesis committee can be called into session to judge the student's con-

tinued participation in the graduate program, or possible alterations in the area of his research efforts. In addition, the student and principal advisor will be expected to consult periodically with the other committee members who may also request the program director to call formal meetings of the thesis committee.

Conflicts between the student and/or any members of the thesis committee not resolvable by the full committee may be referred to the advisory committee of the division or higher authority as specified in the policies and procedures of the Rush Graduate School and College of Health Sciences.

Thesis

The degree of doctor of philosophy is given in recognition of high attainment and ability in a particular field of scientific research as evidenced by submission of a dissertation showing power of independent investigation and forming an actual contribution to existing knowledge. Such dissertation will be submit-

ted to the candidate's thesis committee for review and defended orally, at least three months before the degree is granted. The thesis committee will ordinarily request an evaluation of the candidate's dissertation by a scientist of national stature not affiliated with Rush University.

Acceptance of the dissertation by the thesis committee will be reviewed by the executive committee and the dean, along with the candidate's entire academic performance in the Graduate School. Determination of completion of all requirements will result in the dean's recommendation that the degree be awarded at the next scheduled commence-

ment exercise of Rush University.

Should the candidate not have submitted a dissertation three years after admission to candidacy, the thesis committee shall be convened to evaluate the candidate's progress, and, if it deems it proper, to suggest alteration in the program.

General Policies of the Graduate School

This program is subject to changes required to conform to the general policies and provisions of the Graduate School adopted by the execu-

tive committee from time to time. However, major changes in policy shall not retroactively affect students already admitted to the program.

Research Areas Represented

Members of the division carry out research in three overlapping areas: (1) transport and electrical properties of excitable membranes; (2) motor and sensory processing in the mammalian nervous system; and (3) circulatory phenomena.

Membrane properties. Both the transport and the excitability properties of membranes are under study.

The properties of the digitalis-receptor of the heart, a component of the $\text{Na} + \text{K}$ pump of the cardiac muscle membrane, are being studied. One project is focused on the physiological regulation of this system by hormones. Specifically, changes in cardiac performance that accompany altered thyroid function have been shown to result from altered synthesis of $(\text{Na} + \text{K})\text{ATPase}$ in the cardiac muscle membrane. In a related study the autonomic nervous system was shown to regulate $(\text{Na} + \text{K})\text{ATPase}$ via modulation of cyclic nucleotides. Finally, a technique for the automatic, continuous assay of $(\text{Na} + \text{K})\text{ATPase}$ is being developed.

The basic ionic mechanism underlying the action potential is being studied in voltage-clamped giant axons. Previous investigations have shown that when examined in sufficient detail, the kinetics of sodium activation and inactivation show striking departures from the behavior expected for a system consisting of non-interacting, voltage-sensitive gates such as those implicit in the classical Hodgkin-Huxley formulation. Presently, both traditional voltage-clamp and internal perfusion techniques, and new procedures for noise analysis and measurements of

intramembrane charge movements are being used to further elucidate the molecular details of the sodium and potassium channels.

Problems in synaptic physiology are divided into two classes: the method by which transmitters are released from the presynaptic element, and the nature of the biophysical interaction with the postsynaptic receptor giving rise to changes in membrane permeability. Both questions are being actively investigated.

Nerve cell bodies exhibit a complexity of behavior not usually seen in the axons they support and often contain quite unique sorts of ionic channels. In order to understand such behavior, neurons from simple invertebrate nervous systems are being quantitatively examined using voltage-clamp techniques in much the same way as such procedures have been applied to the problems of nerve excitation.

Skeletal muscle fibers have a structure considerably more complex than nerve axons, including invaginations of the surface membrane which form a tubular system running almost transversely across the fiber. The structural and electrical properties of skeletal muscle fibers are being studied in some detail, and a detailed model of the electrical properties expected from the branching tubular system is being constructed by measuring such properties using methods of linear electrical circuit theory. Techniques include both sinusoidal and stochastic analysis. The theory and measurements are being extended to try to predict the shape and conduction velocity of the propagating action potential, the natural electrical signal that initiates con-

traction. Attention is also being paid to the mechanism by which the action potential occurring across the membranes of the tubular system initiates contraction.

Information Processing in the Central Nervous System. The processing of visual information by the mammalian nervous system is being studied in both human and experimental human preparations. The laterality of information processing in female subjects with Turner's syndrome is being investigated through the recording of visual evoked responses in the electroencephalogram. In animal models visual processing is being studied with microelectrode techniques (extracellular action potentials and evoked population responses); of particular interest here is the effect on the visual system of such homeostatic imbalances as hyperthermia and hypoxic hypoxia.

The control of motor behavior by the nervous system is also being studied in normal human subjects. Responses to different kinds of stimulus-induced errors introduced into the performance of various motor actions are being monitored. The latencies of these responses will provide information as to the CNS level at which they are generated, and their amplitudes will provide a measure of the general level of excitability at different segmental levels. By studying different types of motor actions and using different stimuli, singly and in combinations, it will be possible to uncover information about the motor mechanisms responsible for the coordination of voluntary and involuntary (reflex) behavior.

Epileptic seizures can be induced in animals by a variety of techniques. Such animal

models are being used to investigate the basic mechanisms underlying this behavior and the ways in which seizures may be prevented from developing or controlled. In addition, basic mechanisms of information processing in the mammalian visual and association cortex are being investigated with the aim of elucidating cellular correlates of learning.

Circulatory Phenomena. Three separate projects are under way in this area. The effects of pulsation on blood flow in the laminar transition region are being studied. The pulse has been found to cause an early transition to turbulent flow, an effect that is strongly dependent on pulse amplitude but only slightly affected by pulse frequency. Furthermore, the effect is inversely related to tube length, being unimportant in tubes having the same geometry as actual blood vessels. These results indicate the importance of vessel geometry in protecting the circulation against excessive energy losses from turbulence. A second project in this area involves a study of the microcirculation of skeletal muscle. Of particular interest here is the distribution of flow and the transport of materials that occurs during exercise.

Finally, the responses of the cerebral vasculature to conditions of hypoxic hypoxia are being investigated. Local blood flow, tissue oxygen levels, and neural function (visual evoked responses) are being monitored in an attempt to determine the mechanism(s) responsible for the high sensitivity of the cerebral cortex to oxygen lack. Also of interest are the occurrence and mechanism of oscillations in tissue oxygen tension recorded in some parts of the brain.

Course offerings (*required)

*PHYSO 451

Physiology I. Comprehensive medical physiology course covering all of the major organ systems. A conceptual approach to understanding of physiological functions is developed. Emphasis is placed on utilization of facts in problem-solving. Autumn. Staff.

*PHYSO 452

Physiology II. Continuation of PHYSO 451. Winter. Staff.

*PHYSO 502

Introductory Membrane Biophysics. Study of fundamental processes involved in movement of ions across membranes; excitability in nerve and muscle; equivalent circuit analysis; artificial membrane systems; structure of membranes; active transport processes. Autumn. Staff.

***PHYSO 503**

Physiology of Striated Muscle. Topics include fundamentals of excitation-contraction coupling, mechanics of muscle, equivalent circuit analysis, muscle biochemistry, developmental aspects of nerve and muscle. Autumn. Staff.

***PHYSO 513**

Cardiovascular Physiology. Students will read and discuss the original papers that form the foundations for our current understanding of heart function and control, peripheral vascular control, and transcapillary exchange. The works will be evaluated both in terms of their significance at the time and their present relevance. Winter. Staff.

***PHYSO 514**

Functional Neurophysiology. The course will deal with physiology of neurons and glia, synaptic processes, sensory receptor physiology, spinal cord, cerebellum and motor control, peripheral mechanisms in sensory systems, and higher functions of the nervous system. Relevant neuroanatomical concepts will be included. Winter. Staff.

PHYSO 521

Cell Structure and Function. Topics include current concepts of the structure and function of various cell organelles, histochemistry, and introduction to techniques of electron microscopy. Dr. B. Eisenberg. Alternate years by arrangement.

PHYSO 523

Circuit Theory and Practical Design. A tutorial laboratory course designed to acquaint the student with the principles of design and construction of various electronic equipment commonly encountered in modern physiology. V. Guiffre. By arrangement.

PHYSO 524

Linear Differential Equations and Transform Methods. Study of first and higher order linear equations, linear algebra techniques, finite difference equations, Fourier series and transforms, Laplace transforms, and applications to solution of differential equations. Dr. Mathias. Alternate years by arrangement.

PHYSO 525

Linear Systems Analysis. Topics include block diagrams, feedback, frequency domain analysis, noise and its analysis, and partial differential equations and their solution. Dr. Mathias. Alternate years by arrangement.

PHYSO 526

Control in Physiological Systems. Course covers control theory, the human motor system, and feedback interactions in the human motor system. Dr. Gottlieb. Alternate years by arrangement.

PHYSO 598

Introduction to Research. A tutorial course designed to familiarize students with the literature and techniques applicable to modern physiological research. Variable credit.

PHYSO 641

Molecular Mechanisms in Control of Ion Permeability. Advanced course dealing with special topics in the molecular control of excitability, and laboratory instruction in voltage clamp techniques. Prerequisite: Physiology 501. Dr. Schauf. Alternate years by arrangement.

PHYSO 651

Advanced Topics in Muscle Physiology. Topics include equivalent circuit of skeletal muscle, problems in excitation-contraction coupling, and molecular events in the generation of mechanical force. Dr. Donaldson; Dr. Eisenberg. Alternate years by arrangement.

PHYSO 652

Active Transport Processes. A detailed study of the physiological and biochemical processes involved in the energy-dependent translocation of solutes across cell membranes. Dr. Hegyvary. Alternate years by arrangement.

PHYSO 653

Problems in Synaptic Physiology. A detailed review of current experimental and theoretical problems in transmitter release and activation of post-synaptic receptors. Dr. Lewis; Dr. Pencek. Alternate years by arrangement.

PHYSO 654

Selected Topics in Cardiovascular Physiology. Current papers in active research areas of cardiovascular physiology will be read and discussed. Exact topics will vary with specific student and faculty interest, but may include blood flow dynamics, vascular wall dynamics, exchange and control in the microcirculation, exercise physiology, and modeling of the cardiovascular system. Dr. Rovick. Alternate years by arrangement.

PHYSO 655

Topics in Visual Physiology. An advanced tutorial covering current problems in the function of visual receptors and processing of visual information. Drs. Levett and Michael. Alternate years by arrangement.

PHYSO 699

Research in Physiology Staff. By arrangement.

Affiliated Colleges

Students who seek entrance to the baccalaureate programs in nursing and medical technology at the College of Nursing and the College of Health Sciences apply directly to the affiliated colleges of their choice. Each college provides an excellent basis for the professional portion of the undergraduate programs at the Rush campus.

The participation of each affiliated college with Rush is unique. Carleton and Grinnell ask that students spend three years on their campuses before coming to Rush for the final two years. The other twelve schools require a minimum of two years academic residence. Several schools offer dual degrees—one from Rush with a major in nursing or medical technology, and one from the affiliated college in another major. Each campus specifies requirements for the second degree. Carleton participates only in the undergraduate nursing program. Currently St. Olaf only participates with Rush in an experimental program which provides one month of inter-session residency at Rush for selected students from St. Olaf. During this period, students are exposed to an organized didactic and experiential program intended to inform them more fully concerning health careers.

The pre-health curriculum also varies from campus to campus because of scheduling, curricular offerings and course descriptions.

For specifics about each college it is best to check with the admissions office or health careers advisor on the campus. The affiliated colleges are:

- Beloit College
- Carleton College
- Coe College
- The Colorado College
- Cornell College
- Fisk University
- Grinnell College
- Illinois Institute of Technology
- Knox College
- Lake Forest College
- Lawrence University
- Macalester College
- Monmouth College
- Ripon College
- St. Olaf College

Although the colleges are characterized by their own styles, traditions and programs, each is noted for its academic excellence and liberal arts tradition. The choice of where students spend the first years of undergraduate study is their decision. They may choose any one of the 14 affiliated colleges. Each is a port of entry to the baccalaureate programs of Rush University. The following brief descriptions of each of the colleges will help students make informed decisions.

Beloit College

Beloit, WI 53511
(608) 365-3391 ext. 244

Enrollment 1977-78
Total: 1024
Men: 502
Women: 522

Calendar
Semester Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Strongly encouraged, but
not required

Costs 1978-79
Total: \$5780
Tuition: \$4200
Room and Board: \$1580

Beloit College has been a strong liberal arts college since 1846, two years before Wisconsin became a state. It has maintained a tradition of academic excellence in both the sciences and the humanities.

The student-faculty ratio is 12 to 1; therefore, classes are generally small. All the science faculty hold Ph.D.'s, and department chairmen teach both introductory and advanced courses. The Science Center consists of Chamberlain Hall, a five-story laboratory-classroom building; Mayer Hall, an auditorium building; Kohler Science Library; and Pierpont Wood Conservatory (Greenhouse). Special facilities include the

Thompson Observatory with a 22-inch Celestron telescope, a particle accelerator designed and built by students and faculty, and individual research laboratories for students pursuing undergraduate research. An off-campus area, Camberlain Springs, is used for field work in the sciences.

In addition to using traditional classroom approaches, members of the science faculty have introduced laboratory sessions that allow students to investigate new problems in a real-life manner, collecting data to provide answers to those problems. Background courses are available in chemistry and mathematics for entering students who have insufficient preparation in those areas. Students must spend a term at an on-the-job work experience, but enrollment in the Rush University program fulfills this requirement.

The college is located on a 65-acre oak and hickory studded campus in a community of 36,000 on the Wisconsin-Illinois border, surrounded by farmland and recreational areas. Beloit is 100 miles from Chicago, 75 miles from Milwaukee and 50 miles from Madison. Students from all over the United States and several foreign countries come to Beloit College for an education that produces a distinctive graduate.



Carleton College

Northfield, MN 55057
(507) 645-4431 ext. 511

Enrollment 1977-78
Total: 1781
Men: 945
Women: 836

Calendar
3-3 Plan

Admissions Tests
Required
A.C.T. or S.A.T.

Admissions Tests
Recommended
S.A.T. English Comp.
achievement test, and
2 other achievement tests

Admissions Interview
Recommended

Costs 1978-79
Total: \$5725
Tuition and Fees: \$4037
Room and Board: \$1680

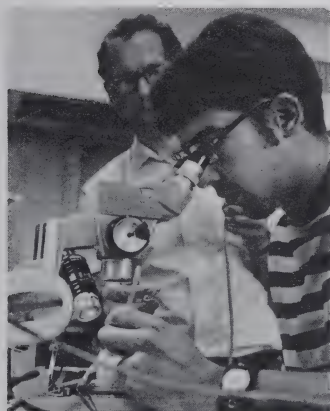
The definition of a Carleton education has over 1700 variations, as is evident in the broad selection of majors chosen by its some 1700

students, either from conventional fields of interest or planned on an individualized basis.

Diversity and individuality both in the student body and in academic programs are an integral part of the college's purpose. Just as no two entering students are alike, no two Carleton graduates fit into a particular mold. They all, however, have been exposed to a range of liberal arts disciplines and have learned to question dogma, value the scientific method, and sensitivity and humanely make ethical decisions.

Carleton's 90-acre main campus, site of its fine science complex, music and drama center, library, and Lyman Lakes, is surrounded by nearly 900 acres of natural woodland and prairie that is utilized as an educational resource, as well as a recreation area.

Located in the southeastern Minnesota community of Northfield, a city of 10,000, Carleton is 40 miles south of Minneapolis and St. Paul and easily accessible by public transportation.



Coe College

Cedar Rapids, IA 52402
(319) 398-1611
(from Iowa
1-800-332-8404)

Enrollment 1977-78
Total: 1139
Men: 522
Women: 460
part-time: 157

Calendar
4-1-4 Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not
required

Costs 1978-79
Total: \$4600
Tuition and Fees: \$3300
Room and Board: \$1300

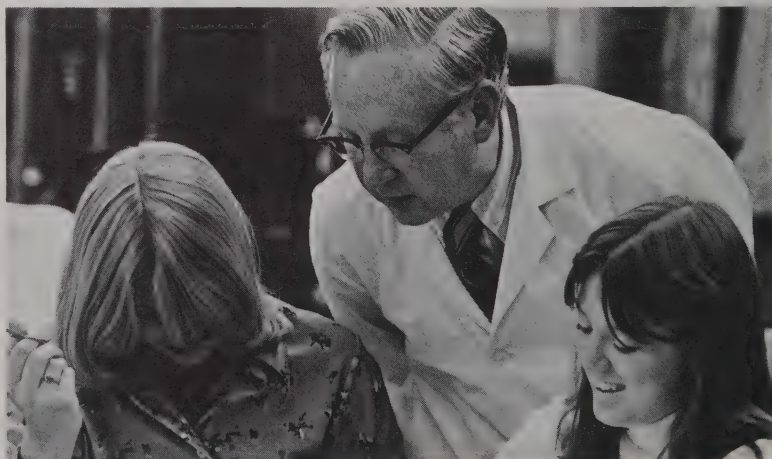
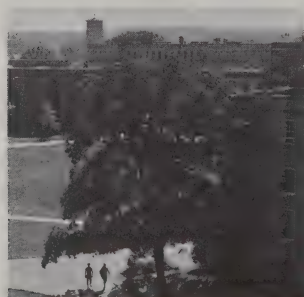
At Coe, through the "open choice" curriculum, students are responsible for making their college experience a meaningful one. A student has the freedom to choose from any of Coe's departmental offerings and build a varied and challenging individual curriculum along with the courses needed for completion of a major. Education does not end in the classroom, however. Students may elect a single term or academic year for studying in one of the 50 foreign and domestic off-campus programs; or, for testing career possibilities, students may participate in a work/service project or work internship.

At Coe, there are students from 40 states and 16 foreign countries. The college is situated in the urban/residential area of Cedar

Rapids, a growing progressive metropolis in eastern Iowa with a population of 135,000.

Degrees offered include bachelor of arts, bachelor of music, and bachelor of science in nursing, from the 28 departmental and interdepartmental concentrations. Many students who are interested in pursuing a medical or health profession will utilize the interdepartmental general science curriculum. Coe provides for its science students modern and elaborate facilities and full use of its quality equipment. Coe is accredited by the North Central Association of Colleges and Schools, the American Chemical Society, National Association of Schools of Music, and the Iowa State Department of Public Instruction.

Coe has an interesting faculty, of whom 70 percent have received their Ph.D.'s and all of whom are strongly committed to their roles as teachers. The 13 to 1 student/teacher ratio permits small and intimate classes and individual attention for the students. Coe maintains the philosophy that intellectual and emotional growth is best nurtured in an environment that is stimulating academically and supportive socially. Coe believes that a liberal arts education will best serve the individual in preparing for the broad ranges of experiences to come through the developing of skills for rational and critical thinking, adequate self-expression, and perceptive dealings with other human beings. Education should be a part of the growth process and Coe would like to have a part in that process.



The Colorado College

Colorado Springs,
CO 80903
(303) 473-2233
ext. 219, 220

Enrollment 1977-78
Total: 1923
Men: 1012
Women: 911

Calendar
Block Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Not required

Costs 1978-79
Total: \$5200
Tuition and Fees: \$3600
Room and Board: \$1600

Colorado College offers an innovative departure from the view of education as "business as usual." Under the Colorado College Plan, the academic year is divided into nine 3½-week "blocks," separated by 4½-day block breaks. Most courses are com-

pleted in one block, though a few span two or even three blocks. A student takes only one course per block.

The Colorado College Plan holds many advantages; it has reduced class size to an average of 14 students; it allows freedom in scheduling classes, so that an astronomy class might meet at midnight, or a biology class can go into the field for a week; it allows the college to attract distinguished visiting professors with ease; and it has contributed to greater involvement in the educational process on the part of the students.

Colorado College is an independent, coeducational, liberal arts college. It occupies a 79-acre campus in Colorado Springs, a city of 200,000 in a metropolitan area of 300,000. It is located at a point where the high western plains meet the Rocky Mountains. The surrounding area offers a natural laboratory for many disciplines, as well as a variety of recreational activities.



Cornell College

Mt. Vernon, IA 52314
(319) 895-8149

Enrollment 1977-78
Total: 855
Men: 438
Women: 417

Calendar
One-Course-at-a-Time
(September-May)

Admissions Tests
Required:
S.A.T. or A.C.T.

Admissions Interview:
Recommended

Costs 1978-79
Total: \$5210
Tuition & Fees: \$3800
Room and Board: \$1410

Cornell has a 125-year tradition of academic excellence, and a reputation, for which our science programs have been largely responsible, to match.

Nearly 70 percent of Cornell's science majors in the last 16 years have entered graduate programs in health careers or the physical sciences. In the past four years, Cornell has earned a 70 percent success rate in medical school placements.

The Cornell One-Course-at-a-Time plan provides an efficient result-oriented approach to scientific studies. Students take one course at a time; classes last three and one-half weeks, followed by a four-day weekend. Instead of four courses competing for your time and best effort, you concentrate on one

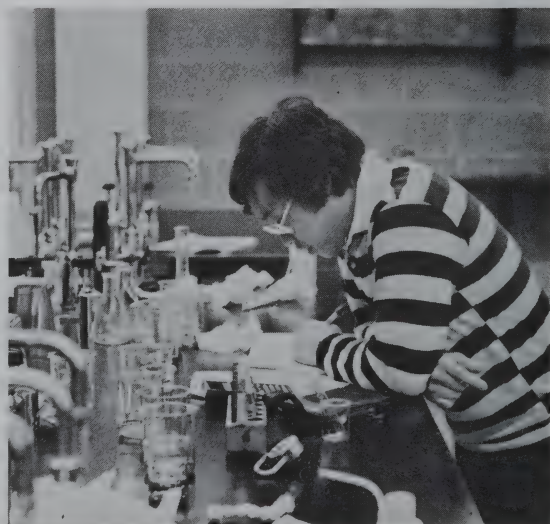
course at a time. Free from the tug-of-war of other courses, you're free to do your best in each course.

And since you take one course each term, there's flexibility beyond the old bind of specific classrooms and time slots. Labs may be scheduled to illustrate course material as you cover it. You may find yourself "in class" at a biology field station, a commercial laboratory, clinic, or hospital.

Cornell's position in the vanguard of undergraduate science education was bolstered recently by the addition of the \$2 million West Center for Biology and Chemistry, which provides Cornell students with state-of-the-art laboratory, classroom, and library facilities.

But the strength of the sciences at Cornell lies in a talented and dedicated teaching faculty, all of whom hold doctorates from leading institutions. And although teaching is their highest priority, the faculty are well represented in the research and publishing fields and apply themselves to Cornell and ACM off-campus programs as well.

Gerard Piel, publisher of *Scientific American*, visited Cornell in 1975 and wrote, "Its science faculty is first rank . . . Their teaching proceeds from research . . . but their professors put a lot more time and heart and brains into their teaching than the distinguished professors at our great 'research' universities."



Fisk University

Nashville, TN 37203

(615) 329-8665

Enrollment 1977-78

Total: 1125

Men: 423

Women: 702

Calendar

Semester

Admissions Tests

Recommended

S.A.T. or A.C.T.

Admissions Interview

not required

Costs 1978-79

Total: \$3735

Tuition: \$2350

Room and Board: \$1385

Learning at Fisk University is a dynamic living experience. The university presents numerous socially-oriented programs through an interdisciplinary approach to higher education. At Fisk, black studies become part of a balanced intracurricular program.

Fisk is located on a 40-acre campus near the downtown area of Nashville, Tennessee. It

offers programs leading to the B.A. and M.A. degrees in 26 major areas of study in the social sciences, natural sciences, mathematics, humanities, physical education, and health.

The traditional excellence of Fisk's programs and its students is evidenced by the fact that in 1930, Fisk became the first black college to receive full accreditation by the Southern Association of Colleges and Schools. In 1952, the school established a chapter of the Phi Beta Kappa Honor Society. In 1975, Fisk became the first predominantly black institution to have a national chapter of Mortar Board. Other national academic societies, as well as major black national sororities and fraternities, have chapters on the Fisk campus.

For sports enthusiasts, complete outdoor sports and recreation facilities, including athletic fields and tennis courts, are available. A municipal golf course is nearby. Fisk students have the opportunity to participate regularly in intercollegiate sports competition.



Grinnell College

Grinnell, IA 50112
(515) 236-4848

Enrollment 1977-78
Total: 1195
Men: 686
Women: 509

Calendar
Semester Plan

Admissions Tests
Recommended
S.A.T. or A.C.T.

Admissions Interview
not required

Costs 1978-79
Total: \$5670
Tuition and Fees: \$4415
Room and Board: \$1255

Grinnell is a private, coeducational, liberal arts college that enrolls students from all parts of the United States and from many foreign countries. Life on the Grinnell campus is informal and individualistic.

Grinnell stresses an integration of private and public responsibility: the first with its attributes of self-knowledge, self-reliance, and intellectual discipline; the second with its qualities of social conscience and concern for public welfare.

Grinnell offers courses of study in the humanities, sciences, social studies, elementary and secondary education, physical education, and other programs. A faculty-student ratio of 1 to 12 permits ample opportunity for independent study, including the Freshman Tutorial Program, guided reading, special projects, and advanced group study.

The attractively landscaped 90-acre campus in a small south-central Iowa City has 35 buildings, including residence halls. Among recreational facilities is the large, multiple-use physical education complex.



Illinois Institute of Technology

Chicago, Illinois 60616
(312) 567-3025

Enrollment 1977-78
Total: 6585
Men: 5389
Women: 1196

Calendar
Semester Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Recommended

Costs 1978-79
Total: \$5130
Tuition: \$3300
Room and Board: \$1830

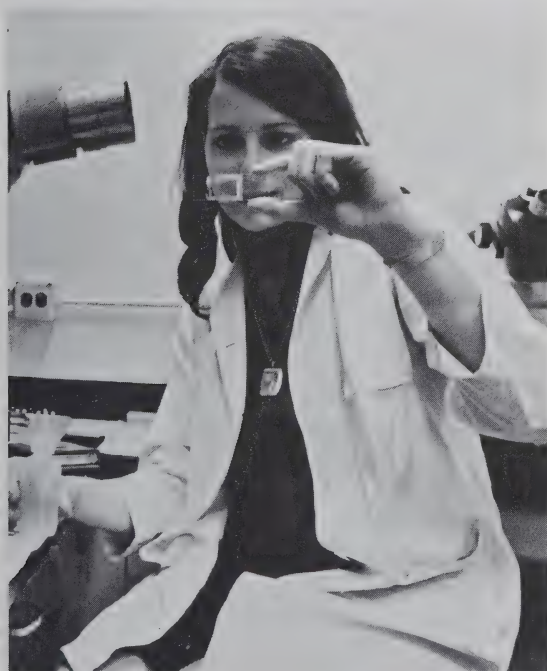
Illinois Institute of Technology is a medium-sized, private, coeducational university emphasizing preparation for professional careers in the sciences, engineering, the social and behavioral sciences, the humanities, architecture, planning, design, management, finance, and law. It offers undergraduate and graduate degree programs through six schools and colleges on both a full-time and part-time basis. In

addition, excellent pre-professional programs are available to prepare students for postgraduate study in medicine, dentistry and law.

Because of IIT's scope and flexibility, students have the opportunity to investigate a broad range of disciplines, pursue specialized programs in non-traditional areas such as biomedical engineering, and with approval, to design individualized programs. In all areas, including biology, chemistry and physics, IIT excels on the undergraduate, graduate, and research levels.

The 120-acre IIT Center is located on the near South Side of Chicago, approximately three miles from Rush University. Facilities include the IIT Research Institute of Gas Technology, the John Crerar Library (1,300,000 volumes), a shopping center, service station, gymnasium and recreation area, six dormitories, nine resident fraternity houses, and the student union.

Applications are welcome from all students who are earnestly interested in an education that prepares them for professional practice.



Knox College

Galesburg, IL 61401
(309) 343-0112

Enrollment 1977-78
Total: 1021
Men: 575
Women: 446

Calendar
3-3-3 Plan

December Mini-term

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Strongly recommended

Costs 1978-79
Total: \$5580
Tuition and Fees: \$4070
Room and Board: \$1510

Knox College, founded in 1837, has for 140 years been dedicated to providing quality education for its students. The College occupies a 60 acre campus located two blocks from downtown Galesburg, a city of approximately 38,000.

The Knox year is divided into three ten-week sessions and one six-week session, the latter, an optional mini-term occurring between Thanksgiving and Christmas. During the mini-term, students are free to find work or to continue their studies.

In addition to the 2-2 Plan (two years at a liberal arts college, two years at Rush), Knox has a 3-2 Plan, under which, upon completion

of the program, students may earn a bachelor of arts degree from Knox and a bachelor of science degree from Rush.

Of the freshmen enrolled at Knox during 1977-78, 45 per cent ranked in the upper 10 per cent of their high school graduating classes. Of faculty members teaching in the 19 areas of study offering a major, 93 per cent hold the Ph.D. degree. The student-faculty ratio at Knox is 11 to 1.

Knox-Rush students have something to say about their experience in the program.

Lisa Arthur, (nursing) from Glencoe, IL: "I am planning to graduate from Knox College with a biology and Spanish major. Last year I studied in Barcelona, Spain, with Knox's program for junior year abroad."

Pam Wetterauer, (medical technology) from Downers Grove, IL: "I combined mathematics and computer science with my chemistry major which will allow me to work with hospital and/or laboratory computers and instruments."

Geraldine Harlan, coordinator of the Knox-Rush nursing and medical technology programs, counsels all men and women interested in the programs. Mrs. Harlan's responsibility is indicative of the concern of the college for the success of the programs.



Lake Forest College

Lake Forest, IL 60045
(312) 234-3100 ext. 200

Enrollment 1977-78
Total: 1046
Men: 547
Women: 499

Calendar
3-1-1-3 Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not
required

Costs 1978-79
Total: \$5930
Tuition and Fees: \$4360
Room and Board: \$1570

Lake Forest College is committed to the development of creative individuals who will live lives of leadership and service. The college has chosen to be a small community

where close personal relationships exist among 87 full-time faculty and 1,046 students. More than 80 percent of the faculty hold the Ph.D. degree. The college maintains a faculty-student ratio of approximately 1 to 12. The diverse student body represents 40 states and 19 foreign countries.

Founded in 1857, Lake Forest College is located on 107 wooded acres in the residential community of Lake Forest, less than a mile from Lake Michigan and 20 miles north of Chicago. The location of the college in the Chicago metropolitan area means that internships and field research projects are important elements of the academic program. To facilitate such experiences the college's seven-week winter term allows students to take program-related jobs or pursue individual research.



Lawrence University

P.O. Box 599
Appleton, WI 54912
(414) 739-3681 ext. 232

Enrollment 1977-78
Total: 1188
Men: 580
Women: 608

Calendar
Three terms,
ten weeks each

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Encouraged, but not
required

Costs 1978-79
Total: \$5700
Tuition: \$4350
Room and Board: \$1350

At Lawrence University, students are able to take advantage of an outstanding faculty, first-rate facilities, and the type of challenging broad-based curriculum one normally associates with a much larger institution. Because of Lawrence's low student-faculty ratio (11 to 1), students who wish to do so may work closely with faculty members in tutorials, on

research, and in independent study projects.

The faculty, 95 percent of whom hold the Ph.D. or the highest degree in their field, staff strong programs in the physical sciences, social sciences, and humanities. In addition, the University's Conservatory of Music, theatre-drama, and art departments provide instruction in the fine arts, while enhancing life both on campus and in Appleton, a bustling city 200 miles north of Chicago and 100 miles north of Milwaukee.

Students may pursue majors offered by 22 departments or, alternatively, design their own programs of study. Lawrence also offers four interdisciplinary majors: economics-mathematics, geology-mathematics, linguistics, and natural science with a concentration.

As in every other aspect of life, quality in education does not come cheaply. Many students at Lawrence, however, receive grants, work/study jobs, and loans to help offset the costs of their education. In the 1977-78 academic year, more than 50 per cent of the University's students received approximately \$2.3 million in financial aid.



Macalester College

St. Paul, MN 55105
(612) 647-6357

Enrollment 1977-78
Total: 1744
Men: 857
Women: 887

Calendar
4-1-4 Plan

Admissions Interview
Recommended

Costs 1978-79
Total: \$5350
Tuition: \$3900
Room and Board: \$1450

Admissions Tests
Required
S.A.T. or A.C.T.

Macalester is a four-year coeducational liberal arts college with a flexible curriculum centered in 27 academic departments. The college, which began its second century in 1974, has achieved distinction individualized learning, internationalism, cooperative programs with other colleges, community involvement, and its commitment to minority youth. Macalester has outstanding resources in people, programs, and physical facilities on its 50-acre campus. Its location in a residential area, midway between the downtown areas of Minneapolis and St. Paul, provides an educational environment that draws upon and contributes to the Twin Cities.

The faculty, 81 percent of whom have doctorates, is comprised of scholars who are dedicated teachers. The typically small classes — 13 to 1 student/faculty ratio — insure personal attention for every student.

Macalester students come from almost every state and more than 30 foreign countries, and nearly 10 percent of the College's more than 1,700 students are from minority backgrounds. In the past 10 years Macalester has had three Rhodes Scholars. Since 1971, 20 students have won Fulbright-Hays Scholarship and related awards. In the past three years, Macalester has had six students receive prestigious National Science Foundation Graduate Fellowships. Macalester ranks eighth among all institutions in members of national merit scholars enrolled since the program began 22 years ago.

Macalester graduates have always had a special affinity for the service professions (medicine, government, education, etc.) and approximately 30 percent of the recent graduates have continued their education in graduate or professional schools.

The college attempts to meet the financial needs of its students through an extensive financial aid program of over \$1.4 million.



Monmouth College

Monmouth, IL 61462
(309) 457-2131

Enrollment 1977-78
Total: 700
Men: 400
Women: 300

Calendar
3-3 Plan

Admissions Tests
Required
A.C.T. or S.A.T.

Admissions Interview
Recommended

Costs 1978-79
Total: \$4740
Tuition: \$3240
Room and Board: \$1500

At Monmouth, our entire effort is directed toward teaching students well and providing the opportunity for each student to achieve the maximum individual growth of which he or she is capable — academically, socially, spiritually, morally, and physically. The college seeks for admission those students who can both profit from and contribute to the total educational programs of the college.

A Monmouth education is an individual experience, its breadth and extent limited only by the willingness of students to learn from a wide range of major fields of study, independent study programs, work experi-

ence, volunteer programs, and a broad array of social and cultural activities. Allied closely to this is the idea that a liberal arts education is a viable link to the future. The college attempts to strengthen this link through small classes, frequent student-faculty interaction, independent and interdisciplinary study, advanced placement, honor programs, and opportunities for special work.

With the recently erected Haldeman-Thiessen Science Center and a natural sciences and mathematics division in which every professor holds the Ph.D., Monmouth's programs in these areas are outstanding.

The Monmouth curriculum allows students to choose from four different types of majors, and students may tailor a plan of study to fit their own particular needs. As well, advanced placement, credit by examination, and other options allow well-qualified students to accelerate the normal four-year program of three terms per year, three courses per term. Monmouth's residential campus of 700 students and 65 faculty makes the student-faculty ratio 11 to 1. Monmouth College was founded in 1853 and is related to the United Presbyterian Church.



Ripon College

Ripon WI 54971
(414) 748-8102

Enrollment 1977-78
Total: 950
Men: 530
Women: 420

Calendar
Semester Plan

Admissions Tests
Required
S.A.T. or A.C.T.

Admissions Interview
Recommended

Costs 1978-79
Total: \$5140
Tuition and Fees: \$3815
Room and Board: \$1325

Ripon, an independent coeducational college of the liberal arts and sciences, founded in 1851, has retained the thoroughly tested principles of liberal education while developing innovations that make learning enjoyable, challenging, and rewarding. For well over a

century, Ripon graduates have gone on to satisfying and responsible careers in virtually every profession and vocation.

Ripon students come from 44 states and 18 foreign countries, and from diverse social, ethnic, racial, and religious origins. Faculty members — 70 percent of whom hold the Ph.D. — are committed to teaching and advising above all other scholarly or professional activities. Since all faculty members teach both introductory and advanced courses, and since the student-faculty ratio is only 12 to 1, students can work closely with outstanding teachers from the beginning of their college careers. More than 70 percent of the classes have fewer than 20 students.

Ripon also offers a full complement of extra-curricular activities and counseling services. Thus, a Ripon education can embrace all aspects of a young person's development.



St. Olaf College

Northfield, Minn. 55057
(507) 663-2222

Enrollment 1977-78

Total: 2975

Men: 1460

Women: 1515

Admissions Tests

Required

S.A.T. or A.C.T. or

P.S.A.T.

Calendar

4-1-4

Admissions Interview

Encouraged

Costs 1978-79

Total: \$4700

Tuition: \$3325

Room and Board: \$1375

Innovative education has been a hallmark of St. Olaf College in Northfield, Minn., since its founding by Norwegian Lutheran immigrant pioneers in 1874.

The 350-acre, wooded campus is located on the western edge of Northfield, 40 miles south of the Twin Cities of Minneapolis and St. Paul.

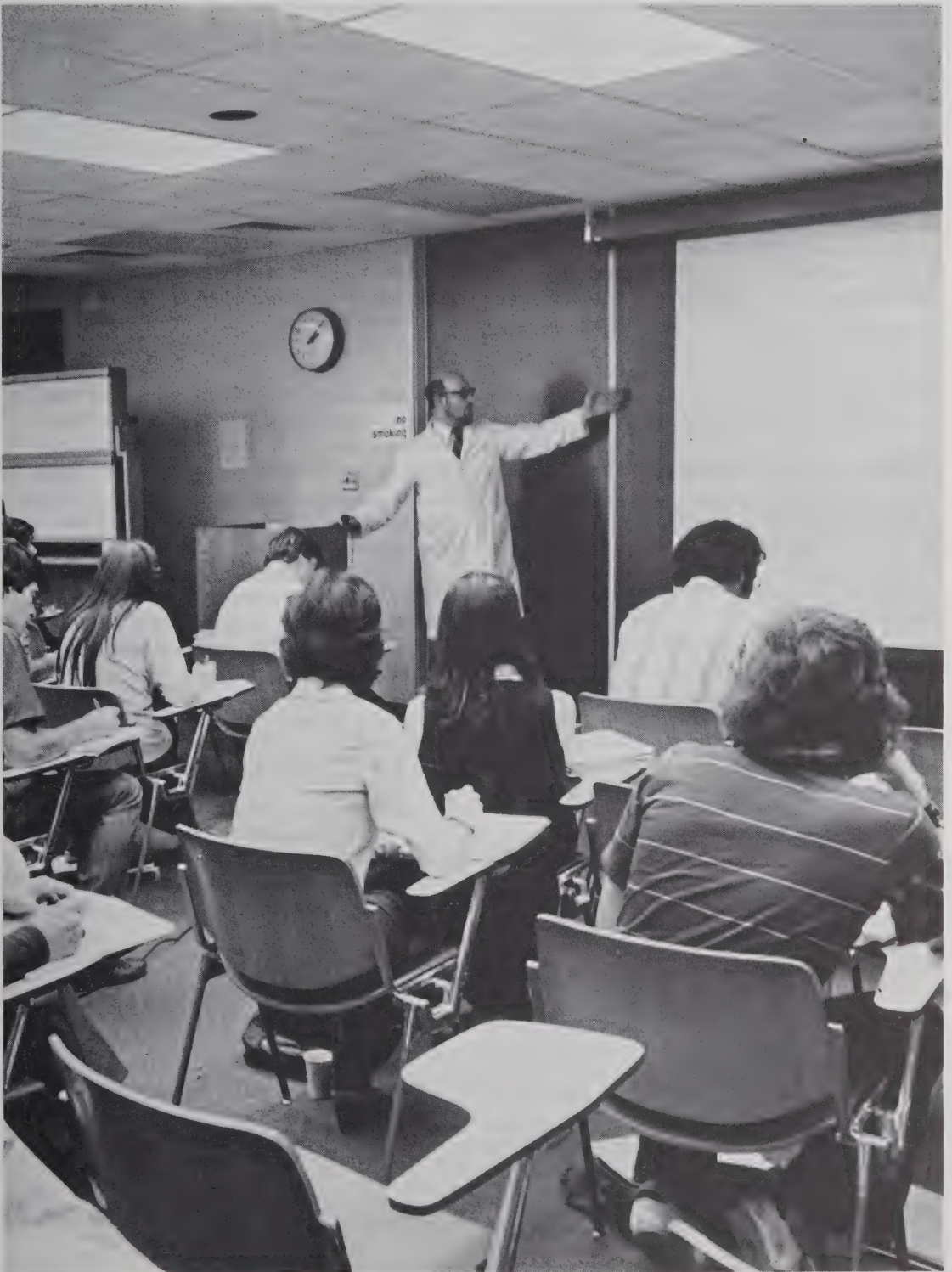
St. Olaf was one of the first colleges to institute the 4-1-4 curriculum calendar. Multidisciplinary course work is expanding each year beyond the 40 majors offered for a bachelor of arts degree. The college also confers bachelor of music and bachelor of science in nursing degrees.

The Paracollege provides individualized studies and innovative learning programs for students who prefer an alternate route to the B.A. degree.

Term Abroad, Global Semester, and Interim Abroad programs provide opportunities for study in 15 countries with emphasis on Asian and Third World cultures. More than half of St. Olaf students study abroad before they graduate.

St. Olaf is a college of The American Lutheran Church. A chapter of Phi Beta Kappa was established in 1949, and an honor system has continued in effect at St. Olaf since 1911.





Course Descriptions

Course Abbreviations

Courses listed and described in this section are Rush University courses expected to be offered by faculty of the College of Health Sciences for the 1978-79 academic year, and do not represent a complete catalog of Rush University courses.

All Rush University courses are listed alphabetically according to the *discipline* to which the course content is most closely related. These disciplines do not necessarily reflect a *department* in the university or in the Medical Center.

Course Numbers

A three-digit course number follows the course abbreviation. Courses numbered 300-399 are third level courses; courses numbered 400-499 are fourth-year level courses;

courses numbered 450-499 are dual level and may be taken for undergraduate or graduate credit; courses numbered 500-599 are graduate level; 600 represents the doctoral level.

Course Content

The course title is followed by a brief description of course content. At the end of each course description are three hyphenated numbers, e.g., (2-3-3). The first number refers

to hours per week in the classroom or seminar; the second, the number of hours per week in laboratory or clinical setting; the third, to numbers of quarter hours of credit.

Independent Study Courses

Students may enroll in an independent study course in any discipline of the university under the direction of the appropriate faculty member with his or her written permission, and the approval of the Office of the Dean.

The course numbers 441 and 591 will be used

for *Independent Clinical Study*, with the appropriate discipline prefix.

The course number 449 will be used for academic *Independent Study* for undergraduates and 599 for *Independent Readings* for graduate students, with the appropriate discipline prefix.

Introduction of New Courses

Upon approval of the faculty, new courses not listed in the catalog may be listed as *Special Topics* under the appropriate discipline

prefix and the numbers 300, 400 or 500 to indicate the level of offering. The topic covered will be listed on the student's academic record.

Course Offerings

Anatomy

ANAT 451

Neuroanatomy. The morphological organization of the central nervous system is explored through lectures, preceptorials, laboratory dissection, and microscopic examination of human brains and spinal cord. Taught as part of NEURO 451 (Rush Medical College). (3)

ANAT 452

Functional Neuroanatomy. The physiology of the normal nervous system and an integrated introduction to the neurochemistry and pathophysiology of diseases of the central nervous system. A series of lectures in basic neurophysiology and neurology with laboratory in neurophysiology. (3 or 4)

ANAT 455, 456

Histology. An introduction to the use of the microscope. The microscopic anatomy of cells, tissues, and organ systems of the human body is studied through laboratories, lectures, and preceptorials. Special attention is given to the fine structural anatomy of cell organelles and individual specializations revealed by the electron microscope. Functional and clinical correlations are emphasized. (3) (3)

ANAT 462

Introduction to Neurobiology. The development, morphology, and functional significance of the human nervous system is presented in lecture and by demonstrations. Fixed human brain preparations and series of neurological slides are used as visual aid materials. Consent of instructor is required. (3-0-3)

ANAT 463

Neurological Aspects of Patient Care. The physiologic factors underlying pain, consciousness, and sleep are discussed, as well as the signs and symptoms of common neurologic disorders. The subject material is presented by means of lectures, demonstrations, and visual aids. Prerequisite: ANAT 462 (1)

ANAT 471

Human Anatomy II. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Laboratory dissection is conducted regionally, encompassing the thorax, abdomen, pelvis, perineum, head and neck, back, and extremities. Radiological anatomy, living anatomy, and clinical correlations are emphasized.

Embryology: The fundamentals of human development are examined from gametogenesis and fertilization through the formation and differentiation of the germ layers, organogenesis, and morphogenesis of the fetus. Congenital malformations and experimental embryology are introduced where feasible. (8)

ANAT 472

Human Anatomy II. The structure and function of the human body are examined topographically through laboratory dissection, lectures, and preceptorials. Embryology is introduced where pertinent. Continuation of ANAT 471. (8)

ANAT 511

Functional Cytology. Study of cellular structure and the application of special techniques will include emphasis on the development of technology and the evolution of contemporary views on the structure and function of tissue components. (3)

ANAT 512

Scientific Basis of Electron Microscopy. This course provides facts about electron microscopy where possible and practical approaches where not. Techniques include the chemical basis of fixation; size and shape changes during fixation, dehydration, and embedding; plastic and frozen thin sectioning; selective staining and immunocytochemistry; autoradiography. We will also discuss the physics of electron optics and the theory of transmission, scanning, high voltage, and x-ray detection electron microscopy. Same as CEBI0 512. (4-0-4)

ANAT 513

Anatomy of the Eye. The histology and embryology of the eye will be reviewed in detail as the basis for discussion of selected topics. These will include congenital malformations, physiology, and pharmacology of selected ocular systems; vessels and nerves of the orbit; and regional structure and function. (4)

ANAT 521

Experimental Morphogenesis. Problems related to normal growth and especially the genesis of complex form will be explored in detail. The class will initially entertain basic concepts in growth regulation. Students will then prepare, present, and analyze current publications on specific morphogenetic problems. Independent research projects will be encouraged where feasible. Prerequisite: ANAT 471-2, 455-6 (4)

ANAT 522

Causal Analysis of Tissue Repair and Reconstruction. The variable ability of mammalian and non-mammalian tissues to repair and to reconstitute themselves will be considered. Original papers on cellular determination, differentiation, cell turnover, and other select topics will form the nucleus of seminar discussions. Prerequisites: ANAT 455-6 or permission of instructor. (3)

ANAT 523

Cell Biology of Vertebrate Repair and Regeneration. Analysis of cytoarchitectural concepts of amphibian appendage regeneration correlated with molecular basis of specific tissue responses to trauma examined principally from histochemical-cytochemical data. This, in turn, will be correlated with tissue repair mechanisms common to all vertebrates. Lectures, preceptorials, and laboratory. (3)

ANAT 524

Morphologic and Physiologic Adaptations in Development, Maturity, Aging and Injury. Analysis of biologic structure and function during vertebrate growth and development and the response of these factors to aging and trauma. (4)

ANAT 541

Mechanisms of Excitation and Contraction. A seminar format will be employed for critical examination of papers relating to the structure and function of muscle. Current topics in excitation-contraction coupling, contractility, and energetics will be explored. Topics will be announced prior to the beginning of the course. Prerequisites: ANAT 455-6, physiology, and the consent of the instructor. (4)

ANAT 542

Neuromuscular Interactions. A review of the fine structure, physiology, and pharmacology of the neuromuscular junction will be followed by examination of experimental systems dealing with the trophic maintenance and the development of muscle fiber types. Contributions of nerve injury to the pathogenesis of muscle disease will be considered. (4)

ANAT 560

Topics in Neurobiology. A seminar format will be utilized to review selected topics and original papers within one of the following units of study: neurogenesis, synaptic organization of neural systems, or current methods in neuroanatomy research. (4)

ANAT 581

Approaches and Methods in Morphologic Research. Study of how sources of information, methods of investigation, and technical procedures are applied to anatomic research. Demonstrations of techniques and student laboratory participation is included. (4)

ANAT 591

Preceptorials in Anatomy. Laboratory experience is provided in conjunction with related preceptorials on selected topics in the anatomical sciences. Prerequisites: ANAT 451-2, 455-6, 471-2. (1 to 3)

ANAT 592

Concepts in Morphology. Seminars and tutorials offered by faculty and guests on topics of special interests in the morphological sciences. (1 to 4)

ANAT 601

Surgical Anatomy. A laboratory program of regional dissections and demonstrations. The applied, clinical, and surgical aspects of anatomical regions is emphasized. Prerequisites: ANAT 471-2 or equivalent. (3)

ANAT 602

Advanced Anatomy. A laboratory program of special dissections and demonstrations on selected regions of the body—thorax, abdo-

men, pelvis and perineum, upper and lower extremities, and the central nervous system (spinal cord and brain). Prerequisites: ANAT 455-6, 471-2, 452 or equivalent. (1 to 3)

ANAT 699

Research. Research devoted to the preparation of a thesis in partial fulfillment of the requirements of the degree program. Variable credit.

Behavioral Science**BEHAV 381**

Research Methodology. Topics include methods for theory construction and theory testing; hypotheses and concept development; operationalization and measurement; sampling; research designs; observational methods; scaling and analysis of data. (3-0-3)

BEHAV 451

Fundamentals of Behavior. Course provides the medical student with the basic conceptual framework and terminology that are used to describe and explain human behavior. It is divided into three sections: biological, psychological, and sociocultural. Primary emphasis throughout is upon the ways such various types of influences interact with health care delivery. It is designed as a series with BEHAV 452 and 453. (23 hours)

BEHAV 452

Observation and Communication. Introduction to the interview technique and process. The interview is studied as a tool that facilitates the doctor-patient relationship and produces reliable and valid medical information. Course covers interview theory, determinants of patient behavior, and practice of interview skills. Weekly seminars utilize video tapes. (28 hours)

BEHAV 453

Behavior in the Life Cycle. Introduction to a clinically based study of the individual life cycle. Emphasis is on the biological, psychological, and sociocultural factors on adaptation during each phase of the life cycle. Lecture and discussion. (30 hours)

BEHAV 461

Death and Dying Seminar I. An examination of the fears and feelings elicited by the clinical experience of contact with the dying patient, and of the fears and feelings of the critically ill patient and how to deal realistically with these fears in a clinical setting. Includes supervised patient contact. Permission of instructor. Graded P or N. (2-0-2)

BEHAV 462

Death and Dying Seminar II. Continuation of BEHAV 461. Individual conferences with advanced students on problems raised in their clinical experiences. Graded P or N. (1-3-2)

BEHAV 501

Behavioral Dynamics. Selected topics provide the basic concepts of intra- and interpersonal behavioral dynamics. The course is designed to aid the clinical specialist or nurse practitioner in understanding the emotional needs of psychiatric patient populations and to guide staff intervention in meeting these needs. Topics include developmental changes with age; socialization and resocialization; personal adjustment mechanisms in stress, conflict, and anxiety; group dynamics and leadership. (4-0-4)

BEHAV 511

Behavioral Deviations. Course serves as an introduction to psychopathology relevant to almost all types of medical practice but of special importance as preparation for psychiatry. General contexts are behavior, psychiatric syndromes, intervention modalities, and research. (27 hours)

BEHAV 521-531

Mini-Course Matrix. A matrix of special topic seminars is presented allowing a concentrated introduction to a significant area of behavioral study. BEHAV 521 is offered in fall; BEHAV 531 in spring. The following topics were presented in 1977-78. Topics may be added or deleted in subsequent years. (10 hours each unless specified.)

Adolescent Pregnancy. The purpose of this course is to help the student develop a knowledge base regarding cultural, socioeconomic, emotional, and psychological aspects of adolescent pregnancy. The course format will include seminar, lecture, and discussion on topics such as 1) the instance and prevalence of adolescent pregnancies and implications for the health provider, 2) the influence of value systems and stereotypic thinking in relation to adolescence, 3) the pregnant adolescent, 4) prevention and anticipatory guidance, abortion, and family planning, and 5) the role of the family of the pregnant adolescent.

Becoming a Physician. This course will present an opportunity to examine the process of becoming a physician. Topics to be covered include socialization into the profession of medicine, the personality and adjustment of the medical student, adaptation to medical training, styles of responding to the medical environment, first encounters with chronic disease and death, and the medical student's personal and family life including marriage, recreation, coping with stress, etc. The course will be both didactic and experiential and students will be called upon to contribute from their own perspective and experience. (20 hours)

Behavior Genetics of Intelligence and Intellectual Dysfunction. This course will consist of an introduction to behavior genetic theory and method. It will review the current status of knowledge concerning the normal distribution of intelligence, and degrees and types of mental subnormality and dysfunction. Implications for medical practice will be reviewed and discussed.

Behavioral Pediatrics and Family Practice. This course will focus on typical behavioral problems of the pre-school (2-4)

and early school age (5-8) child that are seen by the pediatricians and family practitioners. It is designed to assist in the understanding and treatment of areas such as enuresis and encopresis; feeding difficulties; discipline; reactions to separations (hospitalizations, day care); and school-related difficulties.

Chronic and Terminal Illness in Children. Topics for the sessions will include the child's view of the hospital setting, a review of research relating to the effects of illness and hospitalization on children, cultural attitudes toward illness and death, adjustment to chronic illness, and characteristics of successful coping. The test will be based upon a case study of a person who has experienced serious illness or upon the reaction of a member of the primary family.

Clinical Hypnosis. This is an introduction to clinical hypnosis. It will cover the nature of hypnosis, indications and precautions for its use, integrating this modality into clinical practice, more indepth presentation of selected uses, and techniques and skills for clinical application. The format of the class will include lecture, discussion, case presentation, demonstrations, and supervised practice. Following the completion of the course, some students may be ready to use this modality under close supervision. (20 hours)

Clinical Studies of Suicide. This course will attempt to place suicide in a social and clinical perspective and will cover a range of theories of the etiology of suicidal behavior from literature, the social sciences, clinical psychology, and psychiatry.

Death, Grief, and Loss. This seminar will provide an intensive overview of stages in dying, in terms of the experience of individuals with terminal disease, recognition and identification of stages in the clinical setting, and responsive care on the medical, personal, and social levels. The seminar will consider questions often occurring in care of the dying, such as ethical issues (right to die), personal reactions of patients and care-givers, alternative modes of terminal care, and suicide. (20 hours)

Economic Aspects of Health Care. This course will focus on the financing of health

care delivery in the United States, its evolution and current problems, as these relate to public policy and demonstrated needs. Other models of delivery and reimbursement in Great Britain, the USSR, and China will be reviewed. Barriers to effective health care in the U.S. will be described. Possible areas of change and transition will be identified.

Family Systems in Health and Illness. The aim of this course is to acquaint medical students with the inter-relationship between family systems and the health/illness of the family members. Family dynamics that contribute to the formation of symptomatic illness will be examined. Format will include lectures, video tape selections, and group discussion.

Forensic Psychiatry. In conjunction with an attorney, selected cases will be presented illustrating contemporary inter-relationships between mental health, the law, and psychiatry, e.g., an indepth discussion of the issues surrounding the insanity defense as currently utilized in Illinois. Social, moral, and ethical issues related to the question of a defendant's fitness to stand trial will be discussed. Current problems in abuses of psychiatric "power" both within the criminal and civil justice systems will be considered. A field trip to Cook County Criminal Courts will be arranged.

Human Development in Infancy: Issues in Infant-Caretaker Interactions. This course will review the complex process of attachment which evolves between infant and caretaker, focusing on biologic, psychologic, and evolutionary factors that influence the attachment process. Key issues to be highlighted are: 1) The impact of multiple caretakers (kibbutz, child care centers, hospitals) upon development. 2) The effects of privation and deprivation upon attachment (neglect, institutionalization, child abuse). 3) Disorders of mothering and their effects. 4) The importance of attachment in infancy as a precursor for early learning and personality development. Arrangements will be made to allow direct observation of mother-infant interaction in a variety of settings.

Illness Behavior. Health service utilization, or the circumstances under which people

who experience symptoms seek out medical care, is the basic topic of this course. A complex interplay of medical, social, and psychological factors are involved in such decision-making, often influencing individuals to seek care prematurely or to delay and provoke a crisis situation. The decision to seek care and the kinds of help sought will be viewed in terms of major conceptual models of such behavior, research findings, and patient compliance, and application will be made to medical practice in various forms. Case history material will be introduced.

Issues in Pain Management. This course is designed to provide the student with a conceptual framework applicable to clinical situations in which pain is a problem. The psychobiological dynamics of pain and pain syndromes will be presented, with review of treatment considerations. Specific topics include gate control theory, the role of endorphins, the endogenous opioids, the hysterias and hysterical pain, depressive illness and pain, addiction, and iatrogenic considerations. Methods include lecture, student presentations, demonstrations, and discussion of clinical material.

Medical Ethics. This course is intended to provide a context and a conceptual and clinical framework for exploring, questioning, and valuing the "art" and "science" of medicine and health care. While some historical review will be presented, the primary attention will be articulating and examining understandings of the nature of personhood, values and meanings that underlie clinical experience, transmedical meanings in health care, styles and philosophies of leadership in health care, and integrative dimensions of medicine and health care. Current clinical experiences will be examined. (20 hours)

Medicine: A Regulated Industry. This course deals with the variety of governmental regulations on the provision of health care. In the course, the students and faculty will examine judicial, legislative, and administrative controls and limitations on the practice of the healing arts. Special emphasis will be placed on discussions of practical solutions to some of medicine's governmental quandaries, and on familiarizing

the students with means and methods employed in the regulatory scheme and in-house standards for regulation development. (20 hours)

Medical Anthropology. This course will provide an introduction to a variety of alternative medical practices including folk medicine, shamism, curanderismo, and faith healing. These practices will be examined within the context of supportive cultural attitudes and beliefs about health and healing. In addition, linkages between such practitioners and scientific healers will be examined so that potential areas of interface and conflict can be identified.

Neuropsychological Attributes of Aging. This course will consider behavior changes that accompany aging, explore the neuropsychological and psychophysiological correlates of these changes, and suggest implications for general medical care of the elderly; the course will also provide the student with a basic knowledge of psychopathology of aging.

Parenting and Child Abuse. This course will be an introduction to the stresses of normal parenting. The primary focus will be on the abnormal parenting of abusive parents. Although the reasons behind child abuse and treatment for children and families will be considered, our focus will be on the physician's role in reporting, working with parents, and working with the courts. The format will include class discussion, lectures, invited lectures by pediatricians and lawyers, and examination of case material.

Patient & Physician: Prevention in Action. This course draws upon behavioral sciences and preventive medicine to examine a broad area of sociomedical change in the context of the physician-patient relationship. At its core, the elements of this change include emphasis on promotion of health, insurance coverage for ambulatory care, patient education rather than crisis intervention, viewing the patient as a holistic unit striving for health rather than a series of related organ systems, and a shift to a health care system that does not rely for its sustenance on patients being sick. This evolution in care delivery will examine four levels of intervention: a) the patient level, b) the

community level, c) the national level, and d) the level of medical education and training. Implications for medical students and the physician-patient relationship will be stressed.

Principles of Holistic Medicine. This course will review the various organ systems of the body with particular reference to their vulnerability to psychosocial stress factors. Syndromes of interest include psychophysiological disorders such as colitis, peptic ulcer, rheumatoid arthritis, asthma, etc. Lectures and case material will help focus on the etiology, diagnosis, treatment, and management of these conditions.

Psychiatric Diagnosis in General Medical and Surgical Practice. This course will focus upon the recognition of the major psychiatric disorders likely to be encountered in general practice. We will discuss the clinical recognition of depression, hysteria, and the organic brain syndromes. We will review the syndromes themselves, their clinical manifestations, and the management of these disorders.

Psychological Aspects of Medical Diseases. This course will examine the antecedent, consequent, and exacerbatory relationships of psychological factors to disease processes. Emphasis will be placed on a basic understanding of these relationships, ability to recognize the presence of the factors in patients, and guidelines on dealing with their influence. Included will be discussions of general principles as well as characteristics of specific disease entities.

The Psychology and Psychopathology of the Aging Process. This course will focus on the normal and psychopathological processes of aging and the physician's role in the total health care of the elderly patient. Topics for discussion will include: 1) normal psychology of the aging process; 2) interviewing techniques with elderly patients; 3) depression, paranoid reactions, and organic brain syndromes in elderly patients; 4) psychological and psychopharmacological treatment approaches with elderly patients; and 5) the physician and the chronically ill and dying patient.

Psychology and Physiology of Sleep. This course will provide a general introduction to

the physiology and psychology of sleep. It will cover both normal sleep and dream patterns and the deviations that occur with various medical and psychiatric problems. It will also cover the diagnosis and treatment of insomnias and hypersomnias, nightmares, and bad dreams. (20 hours)

Rural Health Care Delivery. This course will trace the natural history, design, execution, and results of a comprehensive biosocial assessment of a poor, black, rural community in Holmes County, Mississippi, which was undertaken for the purpose of developing a baseline for instituting intervention strategies that would have direct application to the community under study. A variety of unique aspects of this program will be the focus of this seminar, especially the ways in which community people were recruited into the program and how they exerted a considerable amount of local control. This research and service program demonstrates an alternative research model for community improvement, which combines scientific rigor with community control, training local staff, development of research paradigms that were analytically valid and humanistically oriented, and will discuss application of this model to intervention strategies in similar settings.

Sleep and Its Pathology. Focusing on a thorough understanding of human sleep, this mini-course describes the electrophysiology of sleep and its stages, the neurophysiology and neuropharmacology of sleep, correlates of dreaming, the need for sleep and dreams, and relation of sleep and dreams to psychiatric disorders. Attention will be given to the diagnosis and treatment of sleep disorders in medical practice.

Sociology of the Hospital. A variety of topics will be covered in this course but primarily the focus will be upon five issues: what organizational variables influence the quality of patient care; what types of dilemmas arise when one attempts to provide clinical services in a bureaucratic system; how do external groups exert social control over hospitals; what is the role of the patient and his/her family in the social structure of the hospital

and what changes are occurring (e.g., Patients' Bill of Rights); and finally, how can social and organizational factors that relate to illness and patient care be modified to increase the quality of care provided. Findings from a study that has been conducted here at the medical center and that pertains to the relations between organizational factors and the quality of care will be discussed when appropriate.

Therapy in the Family. This course will acquaint the student with the theory and practice of family treatment. The properties of the family system will be discussed utilizing as examples either video tape or the students' own experiences. The format will include case studies, video tapes of families and family treatment interviews done by noted family therapists as well as didactic presentations. One section will deal exclusively with the role of the family in psychosomatic illness.

Topics in the History of Medicine. This course will feature a discussion of selected topics in the history of medicine according to the interests of participants. Topics that could be included are women physicians, physicians in art and literature, the development of specialization in techniques and professional roles, and the interaction of medicine, philosophy, and science. Readings will be assigned on the basis of student interest.

Topics in Human Sexuality and Health Care. This course will review several aspects of human sexuality including gender identity development, gender role in men and women, the human sexual response in the male and female, taking a sex history in clinical practice, sex and medical illness, and basic aspects of sex therapy in general practice. (20 hours)

Topics in Health Systems Management: Health Systems Management is an outgrowth of the realization that human health is dependent upon the interaction of the various cultural, social, and economic systems such as those involving education, sustenance, values, etc., with the biologic systems of individuals and hence groups of individuals. In the last several decades, it has become

apparent that there are inherent systems in contemporary societies best understood by multivariate and systems principles. A major component of the total system complex is the health care system that will be the focus of the course. Expansion of information in this area has led to the belief in empirical attempts toward the management of such a system based upon analysis of the elements in it and

methods of impingement upon them. Epidemiology, as it evolved related to medical problems and control programs, overlaps greatly in content and methodology with these sciences. It will be used as a bridge between the conventional medical data base and the planning process as it is envisioned in the current health planning systems.



Biochemistry

BIOCH 301

Basic Biochemistry. A lecture course designed as an intensive introduction to biochemistry. Emphasis is on descriptive chemistry of the main classes of biochemical compounds and metabolic processes in the human organism and on changes associated with disease processes. Prerequisite: one year general chemistry, one course organic chemistry. (4-0-4)

BIOCH 401, 402

Clinical Chemistry I, II. A course on the analytical and biochemical basis of methods used for chemical analysis of body fluids as related to diagnosis and treatment of disease. Topics discussed include blood sugar, carbohydrate tolerance tests, renal function tests, plasma electrolytes, blood gases, proteins, enzymes, and cholesterol. Critical evaluation of methods is emphasized. The laboratory includes experiments designed to instruct students in the quantitative analysis of clinically important metabolites. Emphasis is placed on accuracy, quality control, and fine technique. Manual methods are stressed, with a variety of methods and instruments used. The student learns to apply error theory and statistics in interpreting and evaluating results. Prerequisite: BIOCH 301. (4-0-4) (3-6-5)

BIOCH 403, 404

Clinical Chemistry III, IV. Covers these tests and topics: lipids, special proteins, chemical hematology, vitamins, biogenic amines, elementary toxicology, liver and thyroid function tests, and steroid methods. Principles underlying automated and computer application methods will be discussed. (2-0-2) (2-0-2)

BIOCH 461, 462, 463

Biochemistry I, II, III. A course in the chemistry and metabolism of biologically important compounds, amino acids, and proteins; nucleic acids and protein synthesis; bioenergetics; biochemical function of enzymes; common pathways of metabolism; carbohydrates and lipid metabolism. Additional topics include the integration of cellular metabolism; regulation of hydrogen

ion concentration; the reproduction of the molecular level, including genetic coding and DNA replication, transcription and translation; nucleic acids and disease; hormones; regulation of whole body metabolism; biochemical role of vitamins; calcium and phosphate metabolism. Required of medical students. (3)(3)(3)

BIOCH 501

Advanced Biochemistry I. An advanced lecture course considering enzymology, cell physiology, and the chemistry of the important classes of biological substances, including carbohydrates, lipids, amino acids, proteins, and nucleic acid. It also covers biochemical investigation; chemical thermodynamics; properties of solutions, electrode potentials, chemical kinetics and membrane phenomena. Required of all biochemistry graduate students. (5)

BIOCH 502

Advanced Biochemistry II. An advanced lecture course considering biological oxidations, the pathways of metabolism, the control and regulation of metabolism, nutrition; and the chemical nature, biosynthesis, evolution, and mechanism of action of the hormones. Specific topics deal with the metabolism of proteins, lipids, and carbohydrates with particular attention to recent developments. Required of all graduate students. (5)

BIOCH 503

Advanced Biochemistry III. Topics include structure, physical, and chemical properties of polynucleotides and their components; physical and chemical properties and biosynthesis of nucleic acids; transfer and messenger RNA; and the role of nucleic acids in protein synthesis. Other topics are the biochemical structure and function of specialized tissues, including: the liver, muscle and muscle contraction mechanisms, hemopoietic system, kidney, bone, and connective tissue. Required of all graduate students. (5)

BIOCH 521

Biochemistry of Nutrition. Recent developments in the nutritional aspects of carbohydrates, proteins, lipids, and trace nutritional substances will be covered. Lectures. Prerequisite: BIOCH 451, 452. (3)

BIOCH 522

Molecular Biology. The synthesis, function, and interaction of the various macromolecular components of cells will be studied with emphasis on the sequential residue-by-residue transfer of genetic information; also the synthesis and degradation of the extracellular structural macromolecules with emphasis upon their functions and interactions, and the influence of extracellular matrices on gene expression in normal development and neoplastic states. (2)

BIOCH 523

Comparative Biochemistry. Comparative study of the metabolic strategies and biochemical structures selected by various phyla to carry fundamental biochemical functions. (3)

BIOCH 531

Neurochemistry. Study of selected topics and recent developments concerning chemical events related to brain function. (3)

BIOCH 532

Laboratory in Neurochemistry. Laboratory, conferences, and experiments concerned with brain cellular structure and membranes, enzyme activities, lipids and neurotransmitters, which would familiarize the student with techniques useful in neurochemical research such as ultracentrifugation, gas chromatography, electrophoresis, fluorimetry and others. Prerequisite: BIOCH 531 or consent of instructor. (2)

BIOCH 581

Biological Research Techniques. Discussion and laboratory work surveying and illustrating the practical aspects of biochemical methodology and instrumentation; techniques for the isolation, analysis, and characterization of biologically important substances; and the fundamental principles of radioisotope techniques, and enzyme assay. Required of all biochemistry graduate students. Prerequisite: BIOCH 503. (4)

BIOCH 590

Special Topics in Biochemistry. An advanced course dealing with selected topics in biochemistry. The particular subjects vary from year to year. One to three topics are

considered each time the course is given. Topics include: biochemical genetics; chemistry of enzymes; phytochemistry. Prerequisite: BIOCH 503. (3)

BIOCH 595

Seminar and Journal Club. Student and faculty presentation of assigned subjects of current importance in biological chemistry and related fields. Assigned reading. Required of all biochemistry graduate students. (1)

BIOCH 598

Research in Biological Chemistry. Research on problems of biological importance with members of the graduate staff. Required for a M.S. or Ph.D. degree. Variable credit.

BIOCH 602

Biochemistry of Disease. The alterations of metabolic pathways in various organs and tissue compartments are studied in relation to organ, metabolic, and genetic pathology. The biochemical derangements are illustrated with case demonstrations. Topics are selected and discussed in depth with emphasis on current research work. The facilities of the clinical chemistry laboratory are available to illustrate biochemical changes and their significance. Prerequisite: BIOCH 503. (2)

BIOCH 611

Clinical Chemistry I. Topics include basic aspects of clinical chemistry including general laboratory procedures, collection and handling of specimens, statistics, quality control, automation, normal values; the course also includes lectures on liquid chemistry, metabolism, and methodology; and the chemistry and methodology used for the identification and quantitation of biological compounds such as carbohydrates, proteins, and amino acids, hemoglobin and its derivatives, porphyrins and related compounds. This includes chemical structure, physiological role, intermediary metabolism, normal values, and clinical applications. Required of clinical biochemistry majors. Prerequisite: BIOCH 503. (4)

BIOCH 612

Clinical Chemistry II. Discussions cover the clinical significance, chemistry, and assay methods of biological substances relevant to the areas of toxicology and endocrinology. Toxicology lectures cover types of toxic substances presently assayed in clinical chemistry laboratories, i.e., volatile substances, metals, and nonmetals, and nonvolatile organic substances, including various drugs. In endocrinology, lectures deal with the nature and actions of steroid and protein hormones and methods employed for identification and quantitation. Thyroid function tests are also discussed with emphasis placed on new methodology. (4)

BIOCH 613-614

Clinical Chemistry Laboratory, I, II. Offered concurrently with Clinical Chemistry I and II. The qualitative and/or quantitative analysis of biological compounds of clinical interest are discussed. The graduate students rotate through the various sections of the chemistry laboratory. Instruction and guidance are provided to permit the student to perform the individual assays in order to become familiar with the techniques and instrumentation. Required of clinical biology majors. (3), (3)

BIOCH 621

Laboratory Management and Supervision. This course discusses human problems in management and organization, group dynamics, decision-making, policy formulation, organizational objectives, and restraints. Required of clinical biochemistry majors. (2)

BIOCH 622

Automation and Instrumentation in Clinical Chemistry. Topics include basic principles of the common laboratory instruments, and the meaning of automation and mechanization in today's clinical biochemistry laboratory. Included are instruments such as spectrophotometers, pH meters, fluorometers, nephelometers, flame photometers, and flow-through discrete sample, and centrifugal analyzers. Current trends in automation and instrumentation are reviewed. (2)

BIOCH 623

Science and the Law. Scientific problems encountered by the legal profession are discussed, including patents, products liability, medical malpractice, environmental law, and food and drug law. (2)

BIOCH 624

Enzymology. Mechanisms and action of enzymes of diagnostic interest, including those associated with pancreatic function; factors governing enzyme reactions and enzyme kinetics in relation to the assays of enzyme activities are reviewed. The chemistry, methodology, and clinical application of enzyme systems presently assayed in clinical chemistry laboratories are discussed individually. Also included are demonstrations and discussions of the instrumentation for enzyme assays. Required of clinical biochemistry majors. Prerequisite: BIOCH 503. (3)

BIOCH 690

Special Topics in Clinical Chemistry. The course will be devoted to the consideration of the more modern techniques for the determination of various constituents of physiological fluids and their significance. Topics of special interest to clinical chemists and other clinical laboratory personnel are discussed. Special emphasis is placed on recent developments in instrumentation and methodology and their clinical application. Studies based upon fundamental biochemistry and concurrent theories in the literature: the nature and variations, in health and disease, of serum proteins and serum enzymes; electrophoresis; use of enzymes as diagnostic reagents; the role of computers in clinical biochemistry; and reading assignments are presented and discussed. On occasion, experts in particular areas of clinical biochemistry are invited to conduct seminars. Graduate students are required to prepare and conduct at least one seminar session. Required of clinical biochemistry majors. Variable credit

BIOCH 699

Thesis Research. Post-candidacy. Variable credit.

Cell Biology

CEBIO 501

Cell Biology. Study of ultrastructure and function of the cell organelles; structures covered include the plasma membrane organization, cell-to-cell communication, and cell surface immunoreceptors. Also covered are the mitochondria and phosphorylation, the endoplasmic reticulum golgi apparatus and cell secretion, the cytoskeleton and molecular basis of motility, and the nucleus and cell division. (4-0-4)

CEBIO 505

Seminars in Cell Biology. Each student will give a seminar on a major research topic in cell biology. Use of library indices, review journals, and research journals will be explained. Advice will be given on preparation of teaching slides and lecture organization. Prerequisite: CEBIO 501. (3-0-3)

CEBIO 512

Scientific Basis of Electron Microscopy. This course provides facts about electron microscopy where possible and practical approaches where not. Techniques include the chemical basis of fixation; size and shape changes during fixation, dehydration, and

embedding; plastic and frozen thin sectioning; selective staining and immunocytochemistry; autoradiography. Also discussed will be the physics of electron optics and the theory of transmission, scanning, high voltage, and x-ray detector electron microscopy. Same as ANAT 512. (4-0-4)

CEBIO 522

Electron Microscopy Laboratory. Practical techniques of electron microscopy are addressed. Students dissect, fix, and imbed tissue. They will be taught the use of the ultramicrotome to stain thin sections and the use of the electron microscope. The goal of the course is the preparation of electron micrographs of research quality. Extensive time for practical use of the equipment will be available. Prerequisite: CEBIO 512. (0-8-4)

CEBIO 531

Stereology. This course will present practical and theoretical approaches in the application of measurement to anatomical structures. General principles of estimation of volume surface area and number will be covered by stereology and other techniques. (2-4-4)

Health Care Systems

HCSYS 302

Dynamics of Health Care. An overview of the various contributions representative members of the health team make to the delivery of health care. Component topics include professionalism, ethics, licensure, organizational structure of hospitals and other medical facilities, Medicare/Medicaid, and medical-legal considerations. (2-0-2)

HCSYS 521

Systems of Health Care. Seminar course in the study of the health care delivery system in

the U.S., with particular emphasis on identifying historical forces that have shaped the current system for health care, the organization of the hospital and the medical center, current manpower roles in health care, and the current issues that face the health system today. Discussion will also focus on external forces and controls that substantially affect the health care system. Students will be expected to write a research paper and present it orally to the class. (2-0-2)

Health Care Education

HLCED 451

Perspectives in Clinical Teaching. Seminar in teaching strategies, including theoretical basis, mode of presentation, and application in clinical settings. Exploration of contemporary educational issues and models and their implications for the practitioner/teacher. Emphasis is on creation of innovative and flexible teaching styles in various clinical areas. (4-0-4)

HLCED 454

Development of Instructional Media. The study of media as arts of communication. A survey of communication theory and its relationship to the communication process. Utilizing various instructional media, stu-

dents design a program of instruction relating to some aspects of the health professions. (2-0-2)

HLCED 583

Clinical Investigation I. A seminar course based on the philosophy of science. The central aim of the course is to provide a basis for the utilization of the methods of science in professional practice. Content includes introductory statistics, research methodology, and ethical and legal considerations in clinical research. Prerequisite: introductory statistics. (2-0-2)

HLCED 584

Clinical Investigation II. A continuation of HLCED 583 and Clinical Investigation I. (2-0-2)

Health and Society

HLSOC 454

Health in the Developing Nations. In this course, which recognizes that all nations are in a stage of development, special emphasis will be placed on the problems and resources that affect health care in the less developed nations. (2-0-2)

HLSOC 461

Culture, Race, Poverty, and Health Care. Through selected, identified readings on race, values, stereotypes, frames of reference, poverty, and health care delivery using Learning Through Discussion as a model for discussion, the student will have the opportunity to develop critical thinking in the area of race, poverty, and health care, and apply it to nursing care. (2 or 3 cr.)

Health Systems Management

HSMGT 301

Health Care Management. Organizational design and managerial processes of planning, organizing, directing, and controlling, as well as the dynamics of managerial jobs, are studied. Emphasis is on management strategies and techniques in the area of health care delivery. (3-0-3)

HSMGT 312

Supervisory Management. The supervisor as manager functioning in an environment of legal and social change is studied. Basic managerial concepts are covered as they apply to a health care setting. Fair Employment Practices, health and safety, unions, training, and other managerial topics are discussed. (2-0-2)

HSMGT 321

Principles and Theories of Food Service Management. Introduction to the managerial processes of planning, organizing, directing, monitoring, and evaluating an enterprise. Techniques in management of human, material, and financial resources in the context of a food service operation. Practical experience in a food service setting is provided. (3-3-4)

HSMGT 452

Contemporary Analysis of the Health Science Professions. A seminar study-group approach to selected contemporary issues in the health professions. (The selection of issues will change from time to time as high-intensity trends develop or as student needs

develop.) The issues selected will range across the social, ethical, legal-legislative, economic, and historical roots of the health professions. Senior or graduate standing. (2-0-2)

HSMGT 501, 502

Systems Management I, II. An introduction to the tools needed by a systems manager. Topics cover probability and statistics, general systems theory, operations research, productivity and work measurement, and computer applications. (8-0-8)

HSMGT 511, 512

Health Care Management I, II. An introduction to theoretical components of medical care sociology, health delivery system organization, and health care management covering the entire spectrum from ambulatory through long-term care. The practicum will include structured experiences in the four health systems—patient care, education, research, and management. A research project in one of the four systems is to be presented in both oral and written form. (4-8-8)

HSMGT 521, 522

Management of Health and Hospital Systems I, II. An exploration of the health spectrum and the prevalent delivery systems with special emphasis on the hospital's relationship with its consumers. Students will study various managerial sub-systems commonly found in health care settings and review the constraints placed on management (internal and external) in operating these systems. Areas that will be covered include variables affecting health and health systems, materials management, facilities planning and management, managerial systems, and marketing. (2-4-4)

HSMGT 524

Treatment Process. An introduction to elements (systems) of the health treatment process affecting both inpatients and outpatients. Students will observe the practice patterns of various health providers, examine systems for monitoring the quality of care, identify elements of treatment support systems affecting the operations of the health treatment sys-

tem, and identify the consequences of these and other systems on the patient as an individual. (2-4-4)

HSMGT 528

Health Care Environment—An Organizational Perspective. Introduction to various theories of organization behavior and their relevance to management of clinical and patient care processes. Special emphasis is on problems related to implementing change in the health environment at both the corporate and unit levels in the organization. Focus includes use of control systems to monitor the progress or stagnation of an institution. Limited enrollment. (4-0-4)

HSMGT 531, 532

Financial Management I, II. Study of accounting/financial management principles for students of varying backgrounds and the application of these principles to the myriad operational problems in the not-for-profit environment. The role of financial management in the operation of a health-care institution will include such topics as accounting, managerial and cost accounting, budgeting, and rate setting. (2-4-4)

HSMGT 541, 542

Health Law I, II. A survey of the law affecting the health care industry with emphasis upon the major legal issues arising in a hospital setting. Students study state and federal statutes, regulations, reported court decisions in detail. (2-0-2)

HSMGT 544

Organizational Analysis. A study of the interactions of the various systems within an organization and their impact on the overall purposes and objectives of the institution. Emphasis will be on formulation of a framework for analyzing complex organizations, identification of potential organizational problems, and creation of a new organization. Unique frameworks for problem solving are encouraged. Students will be expected to rationally and systematically analyze strengths and weaknesses of organizational functions and the relationships between the organizations and internal and external systems. (3-4-5)

HSMGT 551, 552

Information Systems I, II. An overview of the role of data processing and techniques of automated information handling in a medical center environment for students of diverse backgrounds. Students will be exposed to certain minimal information systems mandated by federal and state requirements and the logical extensions of these systems that are of internal benefit to the institution. Terms and concepts will be presented in order to give students the type of technical expertise necessary to implement a computer based information system, techniques to support the system including staffing, and a knowledge of the impact such a system will have on daily operations. (2-4-4)

HSMGT 555

Medical Care Organization. An analysis of the administration of personal health care in the United States, including ambulatory services and home health services, and evaluations of health systems. Models and issues such as supply and demand will be approached from an administrator's perspective. Attention will be given to the roles of "new health practitioners," cost data, political or power models, and problems and trends in the development of a national health policy.

HSMGT 561, 562

Health Planning I, II. Planning theories, strategies, and methodologies related to the management of health resources and the development of health policy will be studied. Planning will be approached from a variety of perspectives, including area-wide and institutional planning at both a micro and macro level. Particular emphasis will be given to legislation and regulatory constraints as they affect planning strategies and health policy and to the important role of multi-hospital systems in the future delivery of health services. The knowledge of quantitative techniques and systems and concepts from previous courses will be used in the student's approach to problem solving. (2-4-4)

HSMGT 581

Research Methodology. An analysis of strategies, methods, and techniques of research in preparation for writing a thesis. (2-0-2)

HSMGT 598

Thesis Research. Variable credit.

HSMGT 599

Independent Study. Variable credit.

Humanities
HUM 461

Physician as Writer. A vigorous exploration of selected fiction, chronicles, and autobiography by distinguished 20th century physician-writers (including Wm. C. Williams, Chekhov, and Azuela). Focus will be on writers' unique responses to question of medical ethics, involvement in social issues, and doctor-patient relationships as well as on physician as philosopher and humorist. (2-0-2)

HUM 462

Physician on Stage and in Fiction. A vigorous investigation of distinguished 19th and 20th century plays and novels that feature the doctor as a major character. Works by G.B. Shaw, Eugene O'Neill, Fredrick Durrenmatt, Tennessee Williams, Henrik Ibsen, and Sinclair Lewis highlight the physician in crises, profiles of a scientific man, psychiatrist as character, and the American regional practitioner. (2-0-2)

Immunology

IMMUN 301

Basic Immunology. An introduction to the basic concepts and terminology of immunity including development, structure, and function of the lymphoid systems, the basis of antigenicity, antibody structure, methods of detection and measurement, mechanisms of cellular immunity, white cell function, hypersensitivity reactions, the complement system, and mechanisms of immune suppression and tolerance. (3-0-3)

IMMUN 402

Clinical Immunology. Clinical and applied immunology as it relates to immunologic processes in various disease states. The use of immunology as a diagnostic, prognostic, and therapeutic aid is studied. The laboratory section of the course covers basic techniques of agglutination, cellular separation, and assay methods. Prerequisite: IMMUN 301. (2-0-2)

IMMUN 403

Clinical Serology. A laboratory course on the basic techniques employed in the serological laboratory. Lectures on test principles and practice performing these tests will be covered.

IMMUN 421

Immunohematology. Blood group antigens and antibodies from the discoveries of Landsteiner in 1900 to the present day are studied. Blood banking procedures involved in drawing, testing, storing and transfusing whole blood and its components are discussed. The laboratory section of this course will deal with the basic blood bank procedures including ABO grouping, RH typing, compatibility testing and special antibody studies. Prerequisite: IMMUN 301. (2-6-3)

IMMUN 501

Fundamentals of Immunology. An introductory course of lectures and tutorials, a historical background in immunology, the structure and development of the lymphoid system, antigen-antibody interactions, and the biology of lymphocytes. Variable credit.

IMMUN 502

Basic Immunochemistry. Topics include structure of immunoglobulins; hapten-antibody reactions; the antibody combining site; complement; antibody heterogeneity. Variable credit.

IMMUN 504

Biology of the Lymphocyte Membrane. Study of structure and composition of cell membranes, fluid-mosaic model, properties of the cytoskeleton, receptor redistribution, antigen receptors and cell recognition, and histocompatibility antigens. Prerequisite: IMMUN 502 or equivalent. Variable credit.

IMMUN 505

Complement. Topics include components of the classical pathway, alternative pathways, lysis of cell membranes, complement deficiencies, genetics of the complement system, and regulation and control. Prerequisite: IMMUN 502 or equivalent. Variable credit.

IMMUN 506

Phagocytosis and Host-Parasite Relationships. Topics include mononuclear phagocytes; polymorphonuclear leukocytes; the nature of lysosomes; mechanisms of chemotaxis, phagocytosis, and intracellular digestion; metabolic pathways in phagocytes; role of the phagocyte in disease. Variable credit.

IMMUN 507

Ontogeny and Phylogeny of Immunity. Topics include phylogeny of the lymphoid system, evolution of the immunoglobulins, immune mechanisms in invertebrates, and ontogeny of the lymphoid system. Prerequisite: IMMUN 501, 502. Variable credit.

IMMUN 508

Introduction to Immunogenetics. Study of allotypes, blood group substances, histocompatibility antigens, immune response genes, the major histocompatibility complex, genetics of the H-2 and HLA systems. Prerequisite: IMMUN 501, 504. Variable credit.



IMMUN 509

Tumor and Transplantation of Immunology. A tutorial course, supplemented by extensive reading lists, introducing the immunology of malignancy and tumor biology, allograft rejection and graft-vs-host reactions, immune surveillance, and alloggression. Prerequisite: IMMUN 501, 508. Variable credit.

IMMUN 511

Hypersensitivity and Immunological Mediators. A tutorial course describing the biochemical and cellular mechanisms of hypersensitivity reactions. Prerequisite: IMMUN 501, 508. Variable credit.

IMMUN 514, 614

Clinical Laboratory Immunology. A two-year program of practical and theoretical experience in all aspects of clinical laboratory immunology and immunodiagnosis. Variable credit.

IMMUN 541

Clinical Immunology. The course emphasizes the role of the immune system and the immune processes in health and disease. The course further introduces the student to diseases in which the immune system plays a major role; these include autoimmune diseases; drug hypersensitivity; anaphylaxis; allergic diseases; transplantation and tumor immunology; and immune deficiency syndromes involving B and/or T lymphocytes, complement, or neutrophils. Same as Rush Medical College PPHYS 541. (13 hours)

IMMUN 581

Immunological Research Techniques and Instrumentation. A program of laboratory experience for first year students in several faculty laboratories, complemented by lecture/discussion groups on theoretical aspects of laboratory methods. An introduction to the physical biochemistry of macromolecules; preparation of antigens and antibodies and their detection; chromatograph, electrophoresis, analytical, and preparative ultracentrifugation; spectrophotometry and fluorimetry; light, fluorescence, and electron microscopy; tissue culture

methods; detection, and enumeration of lymphocytes and antibody-forming cells. Demonstration of research instrumentation facilities. Variable credit.

IMMUN 590, 690

General Topics. Tutorial programs supplemented by general reading lists and paper presentation designed to maintain and develop a general understanding of immunology. Variable credit.

IMMUN 592, 692

Advanced Topics in Immunology. Tutorial programs supplemented by general reading lists, paper presentations, and essays concerning the areas of immunology specified by the instructor. This program is aimed at involving the students in the speciality of the various faculty members and at developing literary and critical skills in the expression and interpretation of scientific information. Variable credit.

IMMUN 601

Clinical and Experimental Immunology. The primary emphasis is on clinical and experimental immunology through patient evaluation, laboratory problems, and/or introduction to the clinical immunology laboratory. With the aid of seminar discussion preceptors, laboratory strategy, concept, and methodology are used to study individual problems. Individual research projects are available under the direction of the departmental staff. Elective, 10 weeks for Phase III medical students

IMMUN 621

Cellular and Immunogenetics. Advanced tutorial. Variable credit.

IMMUN 622

Medical Immunology. Advanced tutorial. Variable credit.

IMMUN 623

Immunopathology. Advanced tutorial. Variable credit.

IMMUN 699

Thesis Research. Variable credit.

Internal Medicine

MED 301

Hematology I. Study of normal hematopoiesis including development, metabolism, and function of red cells, white cells, and platelets and an introduction to the various associated hematologic disorders. Includes laboratory experiences dealing with basic routine tests performed in a clinical hematology laboratory, such as manual and simple automated cell counting, hemoglobin and hemacrit determination, and differential counting with emphasis on normal cells. (3-6-5)

MED 401

Body Fluid Analysis. Analysis of various body fluids with emphasis on the theory and practice of clinical procedures. Component topics will include the analysis of urine, gastric juice, cerebral spinal fluid, feces, semen, transudates, and exudates. (3-3-4)

MED 425

Hematology II. Review of normal hematopoiesis and an in-depth study of erythrocyte disorders, their etiology, clinical features, significant laboratory findings and treatment. Includes an introduction of leukocyte disorders. (4-0-4)

MED 426

Hematology III. Continuation of MED 425 with an in-depth study of leukocyte and hemostasis disorders that covers etiology, clinical features, significant laboratory findings and treatment.

MED 435

Advanced Morphology. In-depth study of abnormal cell morphology in the bone marrow and peripheral blood and its relationship to various hematologic disorders; also includes the performance of the more specialized hematologic techniques such as osmotic fragility, special stains. Corequisite: MED 425. (0-6-2)

Medical Physics

MEDPH 311

Medical Physics I. Basic physical principles are applied to medical science, particularly to the function of the human body; includes body mechanisms, strength of material and level systems, sound and process of hearing, thermal dynamics and the body, light optics and visions, electricity and the body, radiation and the body. (4-0-4)

MEDPH 321

Medical Physics II. Application of the principles of optics, electricity, radiation, and electronics to laboratory instrumentation. Prerequisite: MEDPH 311 or equivalent. (3-3-4)

Medical Technology

MEDTK 301

Basic Laboratory Skills. Study and practice of basic laboratory skills used in the various clinical laboratory areas. Topics covered include instrumentation, proper use and maintenance; manual skills such as pipetting, titrating and venipuncture; preparation and standardization of reagents; laboratory calculations. (1-9-4)

MEDTK 302

Patient Care Techniques. Clinical experience in the hospital patient care areas; includes blood collection, specimen handling and processing procedures, as well as interaction with patients and professional staff of the hospital. (0-4-1)

MEDTK 421

Practicum in Clinical Chemistry. Rotation through the hospital clinical biochemistry laboratories. Application of basic skills learned in student chemistry laboratory; instrumentation and advanced methodologies are dealt with. (0-18-6)

MEDTK 422

Practicum in Hematology. Rotation through the hospital clinical hematology laboratories. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. Radio-hematology, bone marrow techniques, and coagulation are included. (0-18-6)

MEDTK 423

Practicum in Immunology. Rotation through the hospital clinical immunology laboratory. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. (0-9-3)

MEDTK 424

Practicum in Microbiology. Rotation through the hospital clinical microbiology laboratories. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. (0-18-6)

MEDTK 425

Practicum in Immunohematology. Rotation through the hospital blood bank laboratory. Application of basic skills learned in student laboratory; instrumentation and advanced methodologies are dealt with. (0-9-3)

MEDTK 441

Seminar in Medical Technology. Discussion of current topics in medical technology and associated fields. Students present abstracts. (2-0-2)

Microbiology**MICRO 311**

Diagnostic Bacteriology. Special emphasis on diagnostic procedures employed in the clinical bacteriology laboratory, such as specimen collection, isolation and identification of medically important bacteria, antibiotic sensitivity testing, and determination of serum antibiotic levels. Course includes laboratory exercises associated with these various concepts. Development of proficient skills in these various techniques is stressed. (3-6-5)

MICRO 411

Parasitology, Mycology and Virology. This course provides clinical background in mycology, parasitology, and virology. Emphasis is on the disease involved and on diagnostic procedures used in the laboratory. The laboratory portion consists of identification, specimen collection, and processing of medically important viruses, fungi, and parasites. Prerequisites: MICRO 311. (3-6-5)

MICRO 451

Microbiology Concepts. The course is designed to acquaint the students with the basic morphological and physiological char-

acteristics of infectious agents. Emphasis is placed on organisms of importance in human disease. General classification of infectious agents, the mechanisms by which these organisms contribute to disease states, and laboratory identification are emphasized. Demonstrations and laboratory work accompany the lecture portion of the course. Required for Phase I medical students. (50 hours)

MICRO 501

Clinical Microbiology. Specimen collection, organism isolation and identification, and interpretation of serology are studied. Infections of various organ systems are covered as a lecture-seminar series and by assignment of pertinent readings. Elective, alternate years by arrangement. (3)

MICRO 502

Viral Oncology. This course offers a comprehensive review of biologic, immunologic, and molecular properties of animal and putative human oncogenic viruses. Techniques employed for investigating the role of viruses in neoplasia are reviewed. Elective, alternate years by arrangement. Prerequisite: MICRO 451 or equivalent. (3)

MICRO 503

Animal Models of Human Diseases. Natural and experimental diseases of animals are compared with similar diseases in man.

Models of selected infectious, immunological, degenerative, metabolic, and neoplastic diseases are presented as a lecture-seminar with bibliographies provided for each model system. Elective, alternate years by arrangement. (2)

MICRO 601

Clinical Bacteriology. The experience provides rotation in each section of the diagnostic bacteriology laboratory with emphasis on laboratory identification of pathogenic bacteria and normal flora. Experience is also provided in the techniques applicable to office diagnostic bacteriology. Clinical work is pro-

vided by arrangement with the Infectious Disease Section. Specimens from patients on the infectious disease service provide data for learning clinical microbiology. Laboratory projects are available for students wishing to pursue individual interests. Elective, duration variable.

MICRO 602

Diagnostic Virology. Specimen collection, virus isolation and identification, and the interpretation of virus serology are studied. Laboratory work involves isolation, identification, and serological techniques of the diagnostic virology laboratory. By arrangement with the Infectious Disease Section, students select cases to be studied in parallel with the laboratory. Elective, duration variable. Prerequisite: MICRO 451.

Nutrition**NUTRI 406**

Human Nutrition. This course is to provide the student with a more in-depth background in nutritional concepts which integrates the sciences of biochemistry and physiology. (4)

NUTRI 410

Seminar and Practicum of Nutrition During the Life Cycle. This course will involve the application of the principles discussed in NUTRI 412 to a clinical setting. The student will be able to observe and participate in many problem-solving experiences that are related to nutritional intervention. (3)

NUTRI 411

Seminar and Practicum in Nutritional Care I. Students apply nutritional knowledge in a clinical setting. Students must understand the pathophysiology that accompanies disease and be able to integrate this knowledge in applying nutritional care. (4)

NUTRI 412

Seminar and Practicum in Nutritional Care II. A continuation of NUTRI 411. (4)

NUTRI 421

Nutrition During the Life Cycle. Course provides educational and clinical skills that will enable the student to integrate the role of nutrition in meeting the needs of an individ-

ual in health and disease. The course will be divided into four parts: cultural, social, and psychological influences on food habits; food needs and costs; nutrition and health; and nutrition in clinical care. (3)

NUTRI 431

Nutrition in Health Care I. Nutritional status as applied to pathophysiology is emphasized in this course. Students will learn the rationale for diet modification in prevention and therapeutic nutritional care. Corequisite: NUTRI 411. (4)

NUTRI 432

Nutrition in Health Care II. A continuation of NUTRI 431. Corequisite: NUTRI 412. (4)

NUTRI 455

Ecology of Nutrition. The sociological, psychological, economic, political, and cultural factors that affect the intake of required nutrients are observed on a global basis. Ecological imbalance, nutritional diseases, and their long-term ramifications on the individual and his/her world are studied in detail. (3)

NUTRI 466

Advanced Human Nutrition. An in-depth study in advanced nutritional concepts that integrates the sciences of biochemistry and physiology. (4)

NUTRI 501

Nutritional Interrelationships I. A study of the dynamic interaction between the animal and its environment, particularly the diet. Chemical and metabolic phenomena involved in the development and maintenance of the mammalian organism are covered as well as regulation as a means of adaptation. Emphasis is on understanding requirements for specific nutrients in individuals and populations, evaluations of food intakes and dietary habits, and on nutritional needs during pregnancy and lactation, growth and maturation, and disease. Corequisite: BIOCH 462 (2)

NUTRI 523

Assessment of Nutritional Status. Identification of the best methods of collecting, recording, and analyzing physical signs, biochemical and anthropometric data, and diet intake. Assessment of the nutritional status and writing of diet and educational plans for clients. Prerequisite: one course in nutrition, biochemistry, physiology, or permission of instructor. (3-0-3)

NUTRI 524

Assessment of Nutritional Status. Same as NUTRI 523 except will include introduction to clinical practice. Required of non-RD's as well as RD's who have not practiced clinically. (3-3-4)

NUTRI 531

Nutritional Self Study. Students assess their own food intakes, dietary habits, and nutritional needs by consuming a diet which they might design for a patient. (1)

NUTRI 551

Practicum I. Course involves clinical practice in implementing and evaluating nutritional care. (1)

NUTRI 552

Practicum II. Course is individually designed by student. Student will spend 9-10 hours per week in clinical practice. In addition, there may be discussion of student-presented cases and clinical care conferences. (3)

NUTRI 553

Practicum III. Same course as NUTRI 552 except student will spend 12-14 hours per week in clinical practice. (4)

NUTRI 555

Ecology of Nutrition. Same course as NUTRI 455 reserved for clinical nutrition students. Students prepare lectures and assist in presentations for NUTRI 455. (4)

NUTRI 561

Special Topics in Nutrition. At least two mini-courses of ten lecture/seminars will be offered each time. Topics will vary. Examples are: total parenteral nutrition, drug-nutrient interaction, protein metabolism. May be taken more than once. One credit for each mini-course taken.

NUTRI 565, 566, 567

Seminar in Nutrition I, II, III. Course includes student presentations of recent literature; speakers, and guests. Students must register for three quarters. (1)

NUTRI 591

Independent Clinical Study. Intensive clinical nutrition study on a subject in a setting agreed upon by the student and advisor. Prerequisite: HLCED 584. (2-5)

NUTRI 599

Independent Reading. Student contracts with a preceptor for independent academic study of a selected topic in nutrition. (2-5)

Pharmacology**PHARM 303**

Nursing Pharmacology I. Course offers general information about drugs, particularly terms used in pharmacology, and factors affecting absorption, distribution, biotransformation, and elimination of drugs. Drugs affecting the autonomic nervous system are discussed. Winter (2-0-2)

PHARM 304

Nursing Pharmacology II. Therapeutically important classes of pharmacological agents are considered in detail to illustrate pharmacological principles and mechanisms of drug activity. Spring (2-0-2)

PHARM 501

Medical Pharmacology. General aspects of the physicochemical factors governing drug-receptor interactions, absorption, distribution, biotransformation, and excretion of drugs are considered as well as drugs affecting the autonomic nervous system. Fall (60 hours).

PHARM 502

Medical Pharmacology. A continuation of PHARM 501. Virtually all important classes of therapeutically useful agents are considered. Winter (60 hours).

PHARM 503

Advanced Medical Pharmacology. A study of mechanisms of action of special classes of drugs. Emphasis is placed on the pharmacophoric moiety and the relationship of the chemical structure to the biological activity. Prerequisite: Pharm 502. Spring (4-0-4)

PHARM 521

Laboratory Instrumentation. Course covers principles and applications of experimental equipment. Techniques that make use of such equipment will include ultraviolet and visible spectrophotometry, spectrophotofluorometry, thin-layer chromatography, column chromatography, high pressure liquid chromatography, gas chromatography, mass spectrometry, atomic absorption, liquid scintillation spectrometry, platelet aggregation, oxygen measurement, blood pressure and flow measurements, cardiac tension measurement, tissue oxidation, isotope use and handling, pH adjustment, sample weighing, melting point determination, hematocrit determination, centrifugation, and glassware cleaning. (0-6-3)

PHARM 531

Pharmacokinetics. A course on advanced aspects of drug absorption, distribution, and elimination. (3-0-3)

PHARM 541

Research in Blood Genetics and Pharmacogenetics. Credit variable.

PHARM 598

Research In Pharmacology. Credit variable.

PHARM 603

Biochemical Pharmacology. Topics include biochemical aspects of pharmacokinetics, structure-function, drug-receptor interactions, and comparative pharmacology. (3-0-3)

PHARM 604

Neuropharmacology. Seminar course presenting both preclinical and clinical aspects of drugs used in the treatment of neurologic and psychiatric disorders. Prerequisite: PHARM 502. fall, winter, spring. Offered in alternating years. (2-0-2)

PHARM 605

Animal models in neuropharmacology. Seminar. Prerequisite: PHARM 604. (2-0-2)

PHARM 621

Cardiovascular-Renal Pharmacology. Course in advanced concepts of drug action as they relate to hypotension, hypertension, and altered flow states. (3-0-3)

PHARM 622

Cardiovascular Experimental Methods. A laboratory course concerned with the techniques involved in preparing experimental cardiovascular animal models. (0-4-4)

PHARM 631

Clinical Pharmacology and Therapeutics. Study of integration of clinical work with therapeutic aspects of pharmacology; includes discussion of the pharmacology, clinical pharmacology, therapeutics, and clinical applications for major drug groups. Prerequisite: PHARM 502. (4-0-4)

PHARM 641

Pharmacogenetics. Advanced tutorial covering current concepts in genetic influences on pharmacodynamics. (3-0-3)

PHARM 691

Pharmacology Seminar. (1)

PHARM 699

Dissertation Research. Credit variable.

Physiology

PHYSO 451

Physiology I. Comprehensive medical physiology course covering all of the major organ systems. A conceptual approach to understanding of physiological functions is developed. Emphasis is placed on utilization of facts in problem-solving. Fall. (5)

PHYSO 452

Physiology II. Continuation of PHYSO 451. Winter. (5)

PHYSO 502

Introductory Membrane Biophysics. Study of fundamental processes involved in movement of ions across membranes, excitability in nerve and muscle, equivalent circuit analysis, artificial membrane systems, structure of membranes, active transport processes. Fall. (4)

PHYSO 503

Physiology of Striated Muscle. Topics include fundamentals of excitation-contraction coupling, mechanics of muscle, equivalent circuit analysis, muscle biochemistry, developmental aspects of nerve and muscle. Fall. (4)

PHYSO 504

Neurophysiology. A conceptual approach to the understanding of central nervous system function. Discussion includes normal function and selected areas of pathology and current research. A one-hour student presentation is required. (2-0-2)

PHYSO 511

Nutritional Physiology I. Discussion of particular physiological systems with relation to principles of nutrition. (5)

PHYSO 512

Nutritional Physiology II. A continuation of PHYSO 511. (5)

PHYSO 513

Cardiovascular Physiology. Students will read and discuss the original papers that form the foundations for our current understanding of heart function and control, peripheral vascular control, and transcapillary exchange. The works will be evaluated both in terms of

their significance at the time and their present relevance. Winter. (4)

PHYSO 514

Functional Neurophysiology. The course will deal with physiology of neurons and glia, synaptic processes, sensory receptor physiology, spinal cord, cerebellum and motor control, peripheral mechanisms in sensory systems, and higher functions of the nervous system. Relevant neuroanatomical concepts will be included. Winter (4)

PHYSO 521

Cell Structure and Function. Topics include current concepts of the structure and function of various cell organelles, histochemistry, and introduction to techniques of electron microscopy. Offered alternate years by arrangement. (4)

PHYSO 523

Circuit Theory and Practical Design. A tutorial laboratory course designed to acquaint the student with the principles of design and construction of various electronic equipment commonly encountered in modern physiology. By arrangement. (4)

PHYSO 524

Linear Differential Equations and Transform Methods. Study of first and higher order linear equation, linear algebra techniques, finite difference equations, Fourier series and transforms, Laplace transforms, and applications to solution of differential equations. Offered alternate years by arrangement. (4)

PHYSO 525

Linear Systems Analysis. Topics include block diagrams, feedback, frequency domain analysis, noise and its analysis, and partial differential equations and their solution are studied. Offered alternate years by arrangement. (4)

PHYSO 526

Control in Physiological Systems. Course covers control theory, the human motor system, and feedback interactions in the human motor system. Offered alternate years by arrangement. (4)

PHYSO 598

Introduction to Research. A tutorial course designed to familiarize students with the literature and techniques applicable to modern physiological research. Variable credit.

PHYSO 641

Molecular Mechanisms in Control of Ion Permeability. Advanced course dealing with special topics in the molecular control of excitability and laboratory instruction in voltage clamp techniques. Offered alternate years by arrangement. Prerequisite: PHYSO 501. (4)

PHYSO 651

Advanced Topics in Muscle Physiology. Topics include equivalent circuit of skeletal muscle, problems in excitation-contraction coupling, and molecular events in the generation of mechanical force. Offered alternate years by arrangement. (4)

PHYSO 652

Active Transport Processes. A detailed study of the physiological and biochemical processes involved in the energy-dependent translocation of solutes across cell membranes. Offered alternate years by arrangement. (4)

PHYSO 653

Problems in Synaptic Physiology. A detailed review of current experimental and theoretical problems in transmitter release and activation of post-synaptic receptors. Offered alternate years by arrangement. (4)

PHYSO 654

Selected Topics in Cardiovascular Physiology. Current papers in active research areas of cardiovascular physiology will be read and discussed. Exact topics will vary with specific student and faculty interest, but may include blood flow dynamics, vascular wall dynamics, exchange and control in the micro-circulation, exercise physiology, and modeling of the cardiovascular system. Offered alternate years by arrangement. (4)

PHYSO 655

Topics in Visual Physiology. An advanced tutorial covering current problems in the function of visual receptors and processing of visual information. Offered alternate years by arrangement. (4)

PHYSO 699

Thesis Research. Postcandidacy research by arrangement with staff. Variable credit.

Pathophysiology
PPHYS 576

Nutritional Pathophysiology I. Study of the pathophysiology and medical management of

disorders related to nutrition and the nutritional status of human beings. Corequisite: PHYSO 511 (2)

Preventive Medicine
PRMED 531

Introductory Biostatistics. A basic introduction to the understanding and use of statistics in the health sciences. Topics covered include descriptive statistics, probability, sampling, point and interval estimation, and hypothesis testing with student's t and chi-square. (3 q.h.)

PRMED 532

Introductory Statistical Data Analysis. This course, along with Intermediate Statistical Data Analysis (PRMED 533), teaches the basic tools necessary to design and analyze a study along sound statistical lines. In this

course, the student will be introduced to the basis of sampling design and regression analysis. The student will also be taught to use a statistical package on the computer. (3-0-3)

PRMED 533

Intermediate Statistical Data Analysis. This course will complete the course of study started in Introductory Statistical Data Analysis (PRMED 532). This course will primarily consider the techniques of analysis of variance and analysis of covariance. There will also be some consideration of multivariate analysis techniques. (3-0-3)

Religion and Health

RELH 501

The Art of Healing. An 11-week intensive clinical course focusing on the interpersonal dimensions of the healing process; appreciation of the patient as a total being; exploration of the anxieties and inhibitions generated in relating to the sick; specialized communication skills; and perception of the patient as a partner in the healing task. The course also assists the student to discover and use his/her own uniqueness in relating therapeutically to the sick.

Note: Students may be accepted for this course from any discipline or field of study. The descriptions of seminars that follow are built upon the experience of teaching the course for theological students. However, no difficulty is inherent in incorporating non-theological students into the course.

Prerequisite: For theological students at least one year of graduate theological education *and* an interview with one of the faculty of the Department of Religion and Health. For non-theological students an interview with one of the faculty of the Department of Religion and Health. (16)

RELH 611

Clinical Case Conference. This clinical seminar uses verbatim written materials or tape recordings of actual patient visits by students. One student presents material each seminar period; all students present in a sequence which they construct. Verbatim materials are circulated to seminar members in advance of the seminar to allow careful preliminary study.

The supervisor and the seminar members engage the presenting student in an examination of his ministry. Together they explore the student's understanding of the patient's communication, the student's assessment of the patient's pastoral needs, the student's attempt to carry out an appropriate ministry, the student's ability to use his/her own faith meaningfully in his/her ministry, and the meaning of the student's subjective response to patients. Variable credit.

RELH 615

Sermon Preparation and Delivery. Students prepare a sermon manuscript and give the sermon in the hospital chapel with their seminar group as the audience. Seminar then relocates and the preaching experience is examined in terms of its appropriateness to the hospital congregation, its articulation of the faith, its witness to the faith and development of the student, and its effectiveness as interpersonal communication. Usually these sermons are amended and given during a Sunday worship service in the hospital chapel. Variable credit.

RELH 621

Personal and Professional Concerns. This seminar gives students the opportunity to report spontaneously on critical events and issues in their hospital ministry; to examine issues of personal or professional identity; to examine problems in communicating or functioning within the seminar group; to explore the meaning and context of their ministry, their relations with other medical center disciplines, their ability to think theologically about their experience; to examine individual problems of functioning effectively in the pastoral role; and to assist students in evaluating their progress in training. Variable credit.

RELH 623

Didactic Presentations. Presentations are made by professionals in other disciplines, by supervisory staff, and by students themselves in an attempt to bring theoretical material to bear on the practical work of ministry and to assist the student in clarifying his/her operational concepts.

From time to time the didactic presentations are more structured to cover various important topics. Some subjects that have been presented in the past or that will be covered in coming quarters include:

Suffering: Its Importance for Health. This seminar explores the various philosophical and theological responses to suffering and

their expression among hospital patients. The implications of the different responses to suffering for healing are explored.

Aging, Faith, and Health. A brief survey of the important biological, psychological, and social changes that accompany aging sets the background for an exploration of the role of faith in the life of older persons, and particularly in their adjusting to and coping with illness.

Faith as a Factor in Health. A brief survey of the major theories of disease and health, scientific and unscientific, Western and non-Western, forms the background for a review of the literature on the role of faith, trust, and hope in recovery from illness. Case examples from student's experience are also reviewed. Variable credit.

RELH 650

Individual Supervision. Supervisor and student together develop an individualized contract for learning. The student is enlisted as a partner in the learning process by helping him/her identify goals, plan for learning, and evaluate progress. Written records of pastoral work are examined in detail as well as written and oral attempts of the student to understand and incorporate the values from the total program experience and to synthesize the clinical, theological, and theoretical data encountered. Supervision of the student on the floor while seeing patients is also provided. Variable credit.

RELH 681

Guided Study or Research. Each student is expected to undertake a reading or research program that is complementary to his/her learning goals and/or remedial in terms of gaps in basic preparation for understanding pastoral care. Supervisor is consultant to the

student for the study program. Note: Expected of year-long students only. Variable credit.

RELH 685

Clinical Practice. Each student has a designated area of pastoral responsibility, usually 40 to 50 beds. Student is assisted to develop working relationships with the treatment team and to develop a style of coverage appropriate to the area.

Each student serves once per week as on-call chaplain for overnight or weekend coverage and/or does an evening of visiting with preoperative patients. These special duties involve the student in ministry in situations of crisis or heightened anxiety.

Clinical practice requires special arrangements for non-theological students. Variable credit.

RELH 689

Comprehensive Evaluations. Each student prepares a written evaluation of himself or herself and the total program experience. This evaluation is shared with the supervisor and fellow students and examined with the student in seminar and individually. The evaluation periods assist the student to examine his or her investment in learning, goals, use of program resources, relationships, and progress toward learning goals. The supervisor prepares a detailed written evaluation of the student at the end of the program that is usually shared with the student. The comprehensive evaluations are necessary for determining satisfactory completion of the course and given credit where appropriate.

The course may not be taken more than twice for academic or field work credit. Variable credit.

Sociology

SOCIO 511

Processes of Social Change. Theories and techniques of analyzing change processes and facilitating change in professional settings are studied. Specific experiences of work in novel

settings or roles will be shared by guest speakers. Theoretical and practical issues on becoming a change agent will be covered. (4-0-4)

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June 1, 1978

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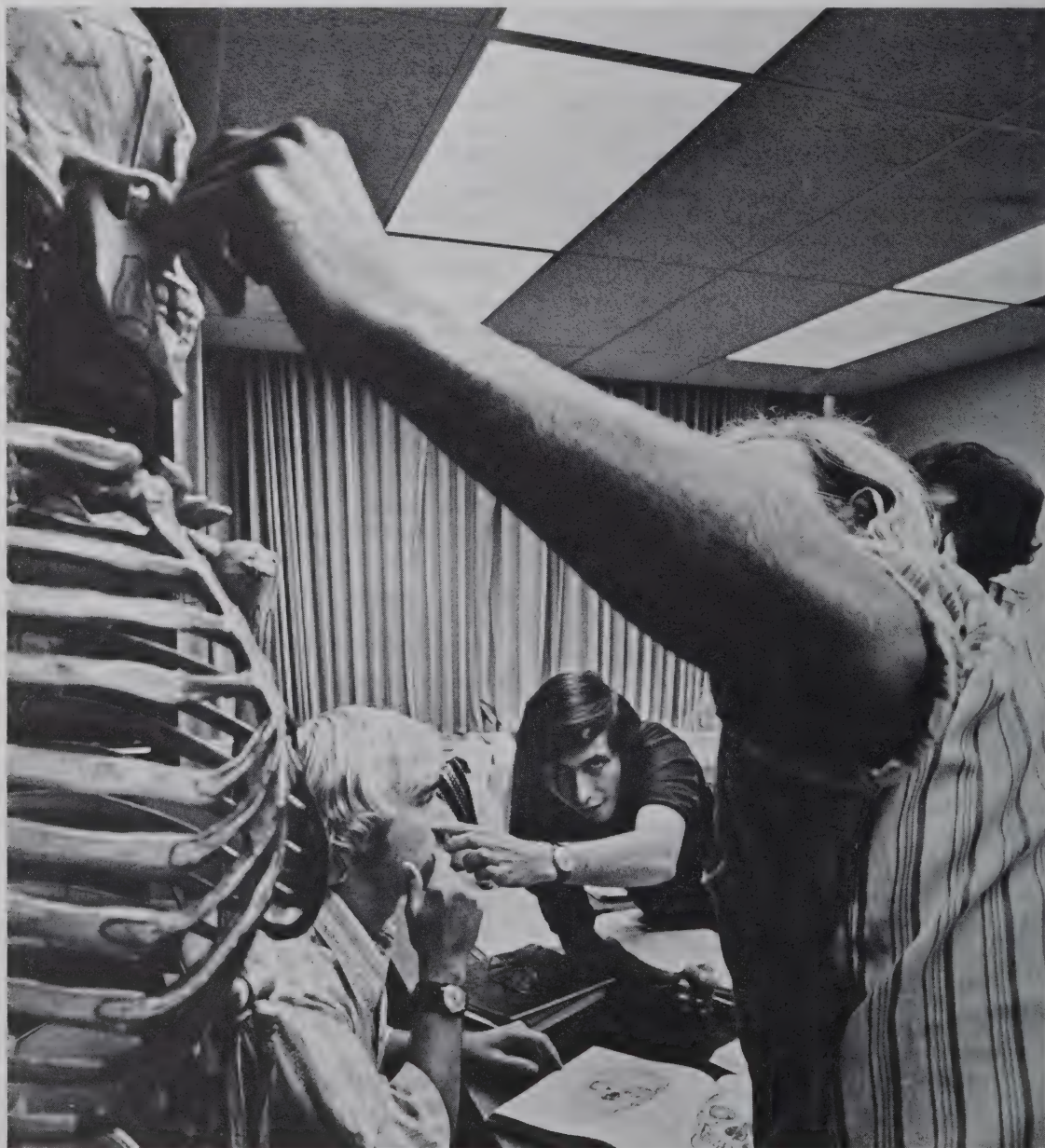
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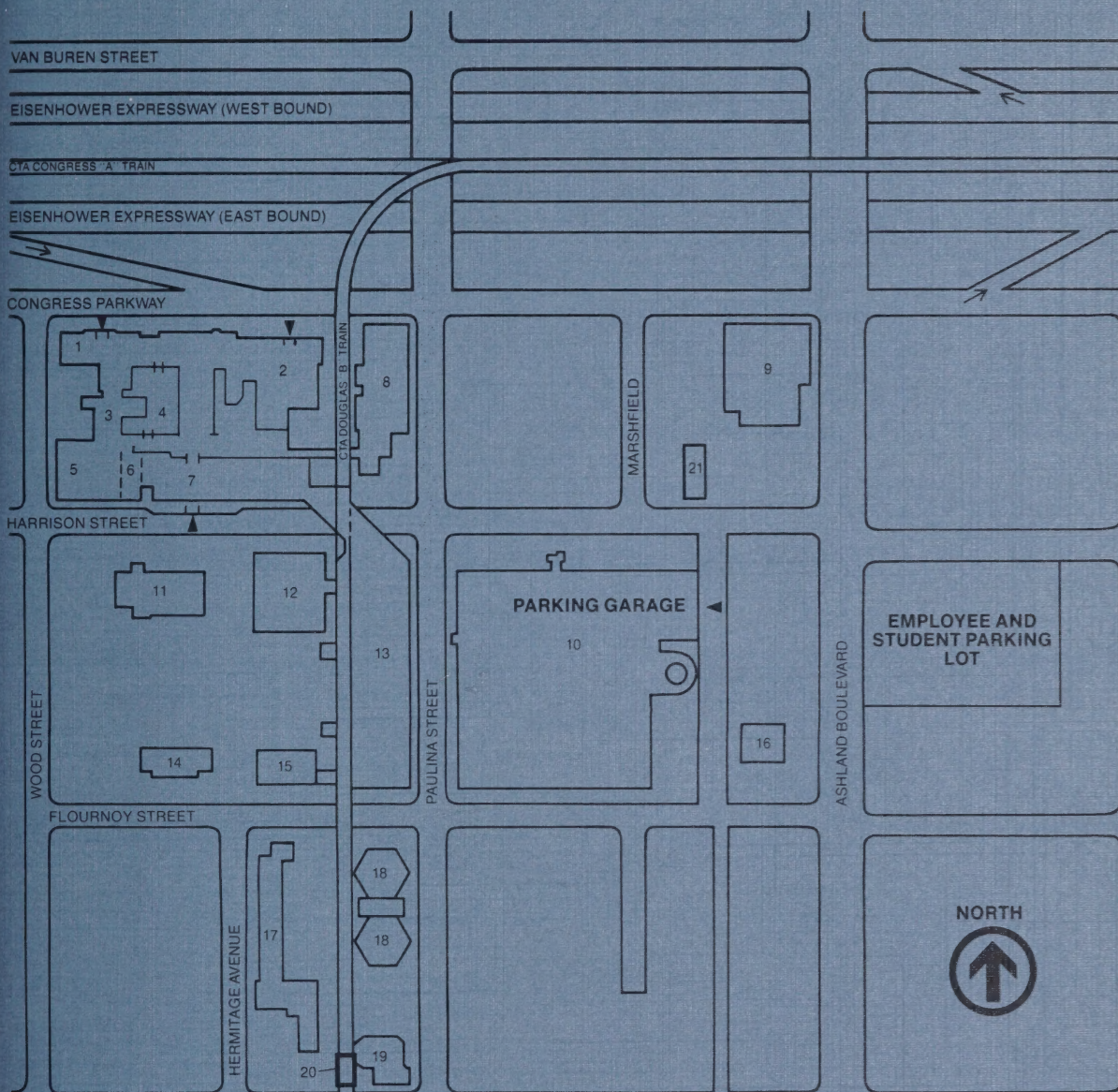
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Rush-Presbyterian-St. Luke's Medical Center Rush University Campus



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| 1. Jones Pavilion | 11. Schweppe-Sprague Building |
| 2. East Pavilion | 12. Professional Building |
| 3. Murdock | 13. Academic Facility |
| 4. Cafeteria | 14. Kidston Apartments |
| 5. Rawson | 15. McCormick Apartments |
| 6. Senn | 16. Laurance Armour Day School |
| 7. Jelke Southcenter | 17. Marshall Field IV Mental Health Center |
| 8. Coyne Building | 18. Johnston R. Bowman Health Center for the Elderly |
| 9. Columbia Bank Note Building (Print Shop and Storage) | 19. Central Refrigeration Plant |
| 10. Parking Garage | 20. Polk Street Station, CTA |
| | 21. Warehouse |

